

00:00:00 welcome to the huberman Lab podcast where we discuss science and science-based tools for everyday [Music] life I'm Andrew huberman and I'm a professor of neurobiology and Ophthalmology at Stanford school of medicine today my guest is Dr Peter AA his second time on the podcast Dr Peter Atia is a medical doctor who did his training at Stanford School of Medicine John's Hopkins school of medicine and the National Institutes of Health he is a world expert in all things related to health span vitality and longevity in

00:00:33 this episode we focused on many topics focusing mainly however on health span and Longevity and mental health health span and longevity of course relate to how long one lives and Dr AA goes systematically through the seven major causes of death worldwide beginning with cardiovascular disease and cerebral vascular disease also cancer also accident related deaths dementia deaths of Despair and in every case explains the three or four major levers that one can employ in order to offset that is to prevent those major causes of death what

00:01:10 follows is an incredibly informative and actionable set of tools for anyone male female young or old he explains the behavioral nutritional supplementation based and prescription drug- based approaches that one can use in order to extend health span and Longevity Dr a explains the key tests and markers that we should all pay attention to if our goal is to extend our healthspan and how to do so while maximizing our Vitality this is something that not a lot of people think about when they think about

00:01:39 health span and Longevity but as Dr AA illustrates for us emotional health has everything to do with our physical health and vice versa and he shares quite openly about his own experiences in pursuing ways to improve emotional health and thereby healthspan lifespan and vitality Dr AA is quite open about his own experiences exploring different practices to improve emotional health as ways not just to improve health span longevity and vitality but of course also to derive the most meaning and satisfaction from Life throughout

00:02:11 today's discussion we also discussed Dr aa's newly released book which is entitled outlive the science and art of longevity this is a phenomenal book I've read it cover to cover now three times I have extensive notes written throughout and the Book of course focuses on longevity and health span and also has an extensive section on emotional health it gets quite detailed into Dr aa's personal experiences with emotional health and tools to improve emotional health that are very actionable for anybody to use I think the best way for

00:02:42 me to summarize my feelings about the book would simply be to read the back jacket quote which I provided so I read quote finally there is a modern thorough clear and actionable manual for how to maximize our immediate and long-term Health firmly grounded in data and real life conditions this is the most accurate and Comprehensive Health guide published

to date outlive is not just informative it is important and indeed outlive is an important book as is the discussion that Dr AA so graciously provided Us in today's episode outlive

00:03:13 is released on March 28th 2023 and is available for pre-order prior to that date you can find a link to where it's sold in the show note captions before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford it is however part of my desire and effort to bring zero cost to Consumer information about science and science related tools to the general public in keeping with that theme I'd like to thank the sponsors of today's podcast our first sponsor is

00:03:41 eight sleep eight sleep makes Smart mattress covers with cooling Heating and sleep tracking capacity as I've talked about before on the hubman Lab podcast there is a critical relationship between sleep and body temperature that is in order to fall asleep and stay deeply asleep your body temperature needs to drop by about 1 to 3° and in order to wake up in the morning and feel alert your body temperature needs to increase by about 1 to 3° the problem with most people's sleeping environment is that

00:04:08 even if you make the room cool the actual environment that you sleep on that is your mattress and underneath your covers is hard to regulate in terms of temperature with eight sleep regulating the temperature of that sleeping environment becomes incredibly easy in fact you can change the temperature of that environment across the night making it a little bit cool at the beginning of the night even cooler still a few hours into your sleep which really helps getting into very deep sleep and then warming it as you

00:04:33 approach morning so that you wake up feeling most alert I've been sleeping on an eight sleep mattress cover for over a year now and it has completely transformed my sleep if you'd like to try eight sleep you can go to 8sleep.com huberman to save up to \$150 off their pod three cover eight sleep currently ships in the USA Canada UK select countries in the EU and Australia again that's 8sleep.com huberman today's episode is also brought To Us by element element is an electrolyte drink that has everything

00:05:02 you need and nothing you don't that means plenty of salt magnesium and potassium and no sugar the electrolytes salt magnesium and potassium are critical for the function of all cells in particular neurons or nerve cells and of course proper hydration is critical for mental functioning and physical performance to ensure that I stay hydrated I consume one packet of element in approximately 20 to 30 ounces of water every morning when I first wake up and I will also consume one element p pet in about the same amount of water

00:05:32 when I exercise or when I'm doing any kind of mental work you know preparing for a podcast writing grants working on papers and so forth I find that allows me to maintain my focus and physical performance at levels that I just simply can't otherwise if you'd like to try element you can go to drink element that's LM nt.com huberman to claim a free element sample pack with your purchase again that's drink element LM nt.com huberman today's episode is also brought To Us by HV MN Ketone IQ hvmn Ketone IQ

00:06:03 is a supplement that increases blood ketones I want to be clear that I am not following a ketogenic diet most people fall into this category they are not following a ketogenic diet they are omnivores and they do eat carbohydrates so their standard fuel source for the brain and body is not ketones however I found that by taking Ketone IQ which we know increases blood ketones I can achieve much better focus for longer periods of time for any kind of cognitive work and much greater energy levels for exercise especially if I'm

00:06:33 going into that exercise fasted and find myself a little bit hungry when I start that exercise and this is no surprise we know that ketones are the brain's and body's preferred fuel source even if you're not following a ketogenic diet so in other words I and many other people are now starting to leverage endogenous ketones as a fuel source for the brain and body and yet we are not following a ketogenic diet and of course if you are following a ketogenic diet Ketone IQ will further allow you to increase your

00:07:01 blood ketones as a source of brain and body fuel if you'd like to try Ketone IQ you can go to hmn.com huberman to save 20% off your order again that's hmn.com huberman the huberman Lab podcast is now partnered with momentous supplements to find the supplements we discuss on the huberman Lab podcast you can go to Liv momentus spelled ous liv.com huberman and I should just mention that the library of those supplements is constantly expanding again that's liv.com SL huberman and now for my discussion

00:07:32 with Dr Peter AA Dr AA Peter welcome back thanks man good to be back and sounding better this time looking forward to talking about a number of important topics with you that you cover in your book maybe we could start off by trying to set the frame for what people should be thinking about in terms of Vitality and especially longevity so I mean I I think you um have to be mindful of how you define these terms and uh I'm not going to suggest that the way I Define them is the only way or necessarily the best way

00:08:11 but I think from a clinical perspective it's the way that makes the most sense to me having thought about this for the better part of a decade so it involves some bifurcation between lifespan and healthspan uh lifespan is very easy for people to understand it is binary you are alive or you are not alive and uh clearly part of longevity is about how long you live uh now I think for a lot of

people that tends to be where the discussion ends that tends to be the focus of it right it's sort of like you know longevity somehow implies

00:08:45 living for you know 100 years 120 years some something like to that extent we talk a lot about maximum lifespan um even in laboratory experiments with mice that's sort of one of the metrics that's that's discussed is what what what's maximal lifespan of the animals um but there's an equally if not slightly I think potentially more important part of longevity which is Health span and health span is squishier and I think it requires some definition now the the medical definition of Health span is the period

00:09:20 of time uh by which you are free from disability and disease uh I find that to be a not particularly helpful definition because by that definition you and I have the same Health span today that we did 30 years ago but I know you pretty well you know me pretty well 30 years ago we were Twice The Men We are now based on what we believe our health span is right in terms of our cognitive function our physical performance and things like that so you know I've clearly experienced the deterioration of my

00:09:52 physical function as I'm sure you have going back to when you were a teenager late teenager early 20s and I think that needs to be cap Ed somehow in health span so the way I think of Health span really is along these three dimensions physical cognitive and emotional again not necessarily suggesting that that's the only way to do it but I do think that clinically it makes the most sense and so therefore anything that really becomes a question of longevity has to address all of these issues lifespan physical health beyond that of

00:10:27 just straight up disability and disease cognitive Health independent of and separate from pathology such as dementia and emotional health which of course is by far the most complicated of all of these because we have no biomarkers for it we have no you know it's not like you can get a scan on somebody and determine the state of this um but nevertheless it's it's important right and it dramatically factors into quality of life so with all of that in mind what are the major exit points for people along the lifespan route let's

00:11:03 just start with the the binary one dead or alive right I think most everyone who's healthy would like to be alive rather than dead so what are the typical ways that people exit from alive to dead and uh how can people stay on the uh free way of life so to speak so this is again a great analysis we internally uh in our practice call this the death bar analysis and it's a surprisingly trivial analysis that I'm just surprised the death bars aren't plastered front and center on every doctor's office um so if

00:11:35 you simply just look at Actuarial data which are readily available through the CDC and do a little bit of data you know manipulation and Analysis you can pretty quickly realize what the horsemen of death are because there's largely speaking kind of Four Horsemen of death um the first and most consequential in terms of the numbers is the diseases of atherosclerosis so that's um cardiovascular disease being the Lion's Share of that but also cerebrovascular disease so anything that has to do with atherosclerosis Rises to the top now

00:12:10 that's that's true in the United States but it's even more true outside of the United States it's even more true globally so in other words when you look at the relative difference between the number one cause of death in the US and number two which is cancer um The Gap is actually smaller in the US than globally globally it's enormous we're talking about 18 to 19 million people a year that are dying of atherosclerotic cardiovascular disease in the world whereas number two is cancer at about 11

00:12:41 million how does the number change when you include um cerebral vascular disease yeah it adds it adds a bit to it um cerebrovascular disease has there's largely speaking you can die sort of through embolic events which are the majority of them can you explain for people what embolic events are yeah so taking a step back what like what what does the brain need more than anything it needs blood flow anything that interrupts blood flow to the brain that results in eseia is uh devastating and it's devastating in a more read you

00:13:11 know readily apparent fashion than virtually any other organ um so one way that that can happen is if a clot or disruption of blood flow occurs through obstruction of blood flow so so that can occur through a clot so for example if a person has atrial fibrillation and a blood clot gets festering in the right atrium and they happen to have a hole in between the you know atria of their hearts called it Pon frame a valley and a clot goes from right to left it can make its way up into the uh arterial

00:13:41 circulation and and and happen that way where you include blood flow the much more common way it occurs is the same way it occurs in the heart which is you have plaque build up and that plaque becomes unstable that plaque ruptures and the rupture of that plaque results in an immediate attempt by the body to fix problem but in doing so it walls off the artery meaning the blood flow distal to that point so that you know now blood is acutely being robbed of that however there are other ways that people can um

00:14:13 have this problem and so you have the whole hemorrhagic side of this so you can have blood vessels that you know small blood vessels in the brain that will rupture as a result of high blood pressure for example so hypertension factors both into both sides of this equation um both in the heart and in the brain uh the majority of these are embolic however so don't quote me

on this exactly but call it four or five to one Strokes result from an embolic phenomenon as opposed to um a hemorrhagic phenomenon a bleeding

00:14:43 phenomenon I don't want to take us too far off on a tangent but as long as we're here talking about bleeds versus clots what are some of the major risks for bleeds I mean I know some people out there have genetic predispositions for being bleeders as they're sometimes called or clotter so things like uh Factor five lien mutations uh which can be exacerbated in women for instance by taking certain oral contraceptives I mean and there's huge list if people are interested in them they can look up you

00:15:10 know what are the factors uh controlling uh bleeding and predisposed people to be in clotter but for the typical person out there who feels healthy um but might do well to know whether or not they are predisposed to be a bleeder or a clotter um what what sorts of things rise to the top of that list and that people might want to check into well I mean there might be sort of two different things going on in that question but I think if your question is when we look at the subset of people who are at highest risk for hemorrhagic

00:15:43 Strokes the far more Germaine question is not underlying coagulopathy the far more Germaine question really comes down to blood pressure blood pressure would be the first second and third driver of that so hypertension is hands down the leading driver of hemorrhagic stroke phenomenon okay so I'll just briefly interrupt and ask um since sometimes your recommendations deviate from the the standards that one would find online or in the typical doctor's office at what point do you get concerned well I'm

00:16:13 I actually find myself uh quite in line with the most recent available data on blood pressure and this has been um obviously this a topic that's of high concern to any Doctor Who's taking care of patients who even pays a fraction of attention to the available literature which is is that basically with each subsequent blood pressure trial the data are becoming clearer and clearer that the more aggressively you manage blood pressure to be within the 120 over 80 range the better so you know there's a

00:16:44 recent study that even looked at going from what used to be considered acceptable which was 130 to 135 over 80 to 85 we used to basically say that's kind of the first level of hypertension and we would say well you know do you really need to be better than that and the answer turns out to be yes you do if you want to reduce heart attacks and strokes be it's better to be 120 over 80 than 135 over 85 now this is a whole other rabbit hole that we don't need to go down but it's a total Obsession of

00:17:12 mine which is how do you measure a person's blood pressure I think this is potentially I'd have to give it thought but honestly I could say top three under diagnosed fixable problems in the United States today and probably globally in other words there are two many people walking around with high blood pressure who don't know it um and I think part of the problem is it's something that is mostly done in the doctor's office and the readings that you get in the doctor's office can be often misleading

00:17:42 you you've heard of this phenomenon of white coat hypertension so you go to the doctor your blood pressure is virtually never measured correctly in the doctor's office that cuff they put on and that squeeze bulb that's if you look at the rigor with which you need to measure a person's blood pressure the right way to do it is the person has to be sitting like this for 5 minutes doing nothing okay folks so when you go to the doctors now you don't let them take your blood pressure sitting for five minutes

00:18:11 and that doesn't include in the waiting room because if you walk get up and walk over right okay so make them stand there right so you you want to be sitting there like this um a manual cuff is better than an automated cuff but not enough people use manual blood pressure so a manual blood pressure means they put a cuff on you and and they actually put a stethoscope on the brachial artery and they're you know using the human ear to listen which believe it or not you would think a machine is better but it's

00:18:37 not the machine can be misled by different sounds now I don't want to suggest that automated cuffs are useless they're not but when an automated cuff gives you an answer that is you know potentially suspect always back it up with a manual I'm pretty Relentless about checking my blood pressure and um so I'll do side to side manual versus automated every day and there's easily a 10 to 15 Point difference between them maybe this is a silly question but can people check their own blood pressure uh meaning manually yeah just could could I

00:19:09 get get a cough in a bulb and and learn how to do it yeah I think so I mean I can do it but honestly I usually have my wife do it she's a nurse um but it's not rocket science check blood pressure I guarantee you there's a great video on YouTube that explains the physiology of it and if you're willing to splurge on a good enough stethoscope and cuff like the cuff I have is really easy to use like it's once you put it on you know it's in a single thing I'm squeezing the bulb and looking at the pressure gauge

00:19:34 while I've got the you know um stethoscope on my artery I mean given the importance of blood pressure and this arteriosclerosis being at the top of the list of uh risks for um dying um it seems to me it might be worth the expense what what's a typical range of cost for for the quality I I I don't it's not it's not inordinate like I feel like my blood pressure cuff is 40 bucks um and

the steth so is a couple hundred bucks if you're getting a good one and um you know good automated cuff there's I I have no affiliation with any of

00:20:06 these companies I use a I use two automated cuffs one's called wiing and the other one's made by a company called Omron om r n um and they're both decent but again they tend to run high and I have yet to find a credible explanation from cardiologists as to why everybody acknowledges that the manual one when done correctly is the answer but I've heard wonky answers about why automated ones are sometimes Incorrect and again it's just made me realize we're not checking blood pressure often enough on

00:20:37 people we're overly relying on blood pressures in the doctor's office which are not being done correctly so we basically have our patients do this relentlessly so how often uh let's say someone buys this because I think for \$240 I mean I realize that's prohibitive for some people but given the cost of some of the other things that are discussed on this and many other podcast first of all I would just have people start with an automated cuff to begin with start with um we have people do it for weeks you know we we our patients a

00:21:04 little spreadsheet that automatically Cates averages and stuff like that tells them what to record and where and we just say look for two weeks we want to see two recordings a day and you know do an morning and an afternoon slpm recording twice a day for two weeks and um let us see those numbers and we'll scrutinize them further and if those numbers come in fine let's revisit in a year will a day ever come when a a watch or a wristband can do this really well so um I hope so and I'm investigating it I I'm actually

00:21:40 G to be trying one out in a couple of weeks with a company that I tried two years ago two years ago when I tried it I was not impressed so I kind of punted on it um the company which I guess I'll not share the name of the company just yet but they they claim that it's significantly better so I'm going to put it to the test again and it's basically a continuous monitor so it it's a wrist device that about every 15 minutes throughout the course of the day will check your blood pressure um to me this

00:22:13 would be I honestly probably more important you know you know how much emphasis I place on CGM as a great thing to be able to test glucose monitor right I I would argue this would be more important when the day comes that we can continuously assess people's blood pressure um it would be an integral part of of a person's you know Health checkup once a year is do two weeks of continuous blood pressure monitoring right now to do that which I've done as well is so cumbersome that it borders on absurd you actually have to wear a blood

00:22:41 pressure cuff that is attached to a clumsy device that goes through the whole insufflation exercise every 15 minutes including while you're sleeping you know it provides some insight but it's so disruptive that it's not what we really want what we the dream would be like a patch that you could put I don't know over your chest that can somehow impute changes in blood flow or something like that and regulate but um we'll see you know op between Optical sensors and things like that I hope that we're getting closer to having something

00:23:14 so I don't want to stroke I don't want to bleed in the brain um I don't want to clot um as long as we're at this number one on the list AR sclerosis being the number one killer what are the major ways to to prevent it yeah so there's three big ones that stand out you know top and center and then there's kind of a fourth one that I think is the the foundational piece so the three big ones we've talked about one blood pressure so if your blood pressure is 120 over 80 or better that's important the second is not

00:23:49 smoking so it turns out that smoking and blood pressure are both devastating for arteries uh but for different reasons right so smoking is devastating from a chemical perspective so it's completely irritating to the endothelium so the endothelium as you know is the Single Cell lining that is the innermost part of the arterial and arterial wall so this is a pretty special organ um again it's it's it's a bit naive but understandable that people just think of arteries as tubes um they're much more

00:24:24 complicated than that they have many layers to them but this particular layer is unusually important it has an outsized importance because it is the one that's in contact with the luminal side right where the blood is flowing in the tube and anything that injures that has significant consequences so smoking is irritating to that in a chemical way and blood pressure is irritating to that in a mechanical way so th those two things basically you just want to that's the lwh hanging fruit in my world right you just don't

00:24:56 want to have those things causing irritation the endothelium because that renders you now susceptible to the third factor which is apob bearing lipoproteins I want to talk about apob um in depth but as long as don't smoke is the second recommendation on the list uh can we better Define um smoking uh and what's being smoked so assume nicotine for um what about cannabis and what about vaping of nicotine and cannabis because vaping has become so much more common yeah it's a great question and it's sadly something we

00:25:31 don't have a great answer for so I can certainly tell you that there's no reason to believe that smoking cannabis is somehow better than smoking cigarettes but the dose seems to be significantly lower in other words you know let's consider a person who smokes a pack a day for 20 years we call that a 20 pack year smoker someone who smokes two pack pack a day for 15 years

is a 30 pack year smoker that's a person who's dramatically increased their risk of U many cancers including lung cancer and also their risk of cardiovascular and

00:26:10 cerebrovascular disease again I'm not a I'm not a THC guy so I don't I can't necessarily speak for the habits of people that are smoking marijuana I can't imagine they're smoking that much probably not yeah so so while on a on a joint to cigarette basis they're probably equivalent in terms of harm it I don't know let's say a person smokes a joint a day that would be like smoking a cigarette a day you know that's a 20th of a pack again I don't want to say that there's no downside to that but it it's it's probably

00:26:45 significantly less so I don't I don't think the risk fully tracks I think the same is probably true for vaping and I I want to be clear like I don't think vaping is a good idea my my you know the last time I looked at the data on this it was surprisingly sparse but to me the only Advantage I could see to vaping was if it was the only way a person would stop smoking so there was you know I sort of looked at it as it was the definitely the lesser of two evils but the by far the better scenario was not to do any of these

00:27:19 things if if nicotine is what you're after there are better ways to get nicotine for example through lozenges and gum and things like that so that you shouldn't be turning to those things to do it but but if it was like if gum is here and cigarettes are here you know vaping was probably here but boy I don't know for those listening uh uh Peter spaced his hands far apart for um gum and smoking and put vaping about a third of the way uh from gum uh toward uh smoking in other words vaping isn't good

00:27:50 for you but it's not as bad as smoking that would be my that would be my I mean do you have a you've probably looked into this as well we did an episode on nicotine I did an episode on cannabis and um you know that the discussion around cannabis gets a little contentious for reasons that aren't um important it's kind of funny people the moment someone starts to confront cannabis as a potential health harm people say it's not as nearly as bad as alcohol which is a crazy argument right getting hit by a bus isn't nearly as

00:28:16 bad as getting hit by a motorcycle in most cases but sometimes you know so that's just kind of silly um and clearly cannabis has medical applications yeah clear clearly um and then it becomes an issue of the ratio of THC to CBD pure CBD forms actually been quite effective for the treatment of certain forms of epilepsy so called Charlotte's Web that's actually what it's called um very high THD containing cannabis clearly predisposes especially young males to later on set psychosis those data are

00:28:45 starting to become clear clear enough to me anyway that people ought to be aware of them at least and maybe make decisions on the basis of those when it comes to the smoking versus vaping it's just very very very apparent that the chemical constituents of The Vape and what people are inhaling are terrible for people and are loaded with carcinogens and a bunch of other stuff many of which cross the bloodb brain barrier so that's what worries me the most you know obviously I'm not a clinician but anytime I hear about small

00:29:18 molecules you know these small inorganic molecules getting across the blood being bar and then being maintained in neurons for many many years I worry because the experiment is ongoing mostly in young people so anyway without going too far down that track I I think if people can avoid smoking and vaping they should and as you mentioned there are other delivery devices for nicotine and cannabis tinctures and patches and uh gums and things that um Edibles that um if people choose to use those substances

00:29:46 that can I I think sometimes people would benefit to to imagine what the surface area of the lung is right if you took the Alvar air sacs of the lungs and spread them out you would easily cover a tennis court remarkable so so just think about anytime you inhale something you are exposing your body is so Adept at absorbing it I mean we have this unbelievable system for gas exchange that was designed for gas exchange and anytime you're putting something else in that WG you're doing a really good job

00:30:21 of getting it into your body so be mindful of what that is um and and that look that applies to to pollution too I mean the the PM 2.5 data is pretty good I I think once you so particulates that are less than 2.5 microns are are getting straight into the body um which is like a great argument for avoiding air pollution right I mean I I always find it funny not to get off on this tangent but to me the most compelling arguments around cleaner energy have nothing to do with greenhouse gases they

00:30:53 have to do with air pollution I promise you more people are dying from the part ulate matters in air that result from burning coal than are ever going to die from the CO2 emissions that result from that it's not it's and and and I would argue that's going to be two orders of magnitude it's not even in the same zip code makes sense during the fires which seem to follow me uh because when I was in Northern California there were a bunch of fires and we were constantly looking me wake up in the morning

00:31:22 everything was covered with Ash uh my dog was having trouble breathing I was having trouble breathing everyone was suffering uh but but there are websites that one can go you can just look at air pollution and and we tend to only do this during fires then I'm you know when I'm in Southern California there tend to be fires here so um you know it's correlation not causation but

um for sure I didn't set those fires folks but it's clear that it disrupts your breathing for a very long period of time

00:31:47 but it's the long taale of that that we're really talking about here the very small particulate that we know firefighters for instance and certain um industrial workers can end up with that stuff embedded in their brain tissue for extremely long periods it's just not good um you make a really interesting point about um the the uh the call for cleaner energy um can we run that one up to to uh Washington or settle some of the debates about climate change just by getting straight to heal bypass all all

00:32:14 the garbage that's um that's being spewed back and forth and just and basically get to the issue at hand right yeah just just just make it better for people to not die from the direct consequence I'd like to take a quick break and acknowledge one of our sponsors athletic greens athletic greens now called ag1 is a vitamin mineral probiotic drink that covers all of your foundational nutritional needs I've been taking athletic greens since 2012 so I'm delighted that they're sponsoring the podcast the reason I started taking

00:32:43 athletic greens and the reason I still take athletic greens once or usually twice a day is that it gets me the probiotics that I need for gut health our gut is very important it's populated by gut microbiota that communicate with the brain the immune system and basically all the biological systems of our body to strongly impact our immediate and long-term health and those probiotics and athletic greens are optimal and vital for microbiotic health in addition athletic greens contains a number of adaptogens vitamins and

00:33:11 minerals that make sure that all of my foundational nutritional needs are met and it tastes great if you'd like to try athletic greens you can go to athletic greens.com huberman and they'll give you five free travel packs that make it really easy to mix up athletic greens while you're on the road in the car on the plane Etc and they'll give you a year supply of vitamin D3 K2 again that's athletic greens.com huberman to get the five free travel packs and the year supply of vitamin D3 K2 so trying to avoid oer such a

00:33:44 difficult word to say especially for a neuroscientist arterial sclerosis did I get it right well it's AO which is easier because yeah atherosclerosis oh there I've been making life more complicated for myself typical of Me Okay um so blood pressure keeping it 128 120 over 80 or better don't smoke let's just throw in don't Vape sure I'm going to just plant my flag on just don't B there are other ways to get those things in your system if you really want to get nicotine or cannabis into your system

00:34:14 APO what's the story with apob okay so to explain this you have to tolerate a little bit of chemistry um so everybody's heard of cholesterol and uh I I I certainly devote quite a bit of time in the book to explaining this because it is so important um and it's definitely one of those areas where I initially received a lot of push back from the editor and there was a thought that hey this is a bit more technical than it needs to be but I I think that sometimes you do need to resort to longer dissertations to dispel mythology

00:34:52 so cholesterol is a lipid it is a molecule that the body synthesizes it is a molecule that is essential for life so if you cannot synthesize cholesterol you can't live you you'll die in utero so there are rare genetic conditions that prevent the successful synthesis of cholesterol uh you know embryos that have those mutations do not survive okay so why do we need this stuff so we need this stuff primarily for two reasons first it makes up a very important structural component of cell membranes so as you know a cell is

00:35:32 a sphere we look at them and think they're circles but they're spheres and they're fluid right they they aren't just like little perfect you know big bowling balls or you know balloons they actually morph and shape and move in these paths and this is what it's what allows cells to be next to each other and all sorts of things they also have channels across all of them and those channels are held in place by among other things cholesterol and phospholipids the second thing that makes cholesterol so important it is the

00:36:04 precursor to some of the most important hormones in our body so our sex hormones testosterone estrogen progesterone in addition to glucocorticoids if you look at them it's really funny you know people if you're looking at if you Google like give me the structure of these things you're kind of like wow they're all basically the same they all look really similar and they're all pretty much just templates of cholesterol so understandably when it's something that's that important the body would leave nothing chance we make all

00:36:29 of our own cholesterol the cholesterol that you eat in food largely irrelevant it's aerified cholesterol so it means it has an Esther side chain it's too bulky to absorb in the gut so most cholesterol that you eat in food just goes out your GI tract okay so we have this super important molecule that every cell in the body makes but there's a bit of a problem there's actually two problems the first problem is not every cell can make as much as it needs all the time so you have this demand problem so for

00:37:01 example if you're sick you're going to need to make far more glucocorticoids your body's response is going to be to ramp up cortisol production to mobilize Fuel and do a whole bunch of other things and certain cells like the adrenal glands are going to be called on to rise to a higher level of performance and they're not going to be able to make enough cortisol so they're

going to have to borrow or take cholesterol from other cells in the body in fact one of the things we used to notice in the ICU I

00:37:30 never knew why it was happening I now know is the few times I would accidentally order the wrong set of Labs on a patient in the ICU and also order like a lipid test or something you would always notice their cholesterol levels were dropping you know serum cholesterol levels and I now realize why because they were basically just funneling cholesterol to the adrenals to make more of the cortisol that they needed to combat whatever they were in the ICU for which is usually the most severe form of

00:37:59 you know stress the body is under so you have to be able to transport this stuff and then the second problem is as you know cholesterol being a lipid is not water soluble so the the most dominant Highway in the body is the circulatory system we we can use the lymphatic system and things like that but for the most part we use our circulatory system as the highway to move stuff around and the highway is made up of water plasma which is what is the liquid component of your blood is water and therefore things

00:38:32 that are water soluble move easily so glucose uh sodium electrolytes all of those things are dissolvable in water and therefore they don't need a carrier you just dissolve them in the water and they can go so that's why your liver can make glucose that your brain can easily get and there doesn't need to be a carrier or an intermediary or anything like that but unfortunately with cholesterol being a lipid we can't do that just as water and oil don't mix cholesterol and plasma don't mix so the body had to come up with a trick and the

00:39:05 trick was designing a vehicle that was water soluble on the outside and fat soluble on the inside that you could bury the cholesterol inside along with triglycerides and on the outside it was covered in protein which is water soluble and that's the that's the thing that moves around and that thing is called A lipoprotein and as its name suggest it's part lip Li part protein lipid on the inside protein on the outside and those lipoproteins um come largely in two different families uh so one family comes from a

00:39:42 lineage called apob so the apob family which is short for APO lipoprotein B1 100 is a family that is derived from the liver and each of those lipoproteins has one and only one APO lipoprotein b00 on it we shorten it and just call it APO B because we don't really worry about APO lipoprotein b48 which is attached to kym microns that are responsible for fat absorption in the gut they're very shortlived They Don't Really factor into atherosclerosis so we're going to just for the purists out there there's an

00:40:18 apob 48 we're not going to talk about it so when I say apob what I'm talking about is a protein that wraps around a subset of these lipoproteins there's another family of lipoproteins called apo a or APO lipoprotein a this is a much more complicated family and I'm not going to talk about it here because we're we would take an hour to just explain how the APO lipo protein a family works but I'll I'll I'll I give the punchline is there are many APO lipoprotein A's there's variable numbers of aoas on those proteins and they are

00:40:54 all part of a family called high density lipoproteins to the apob guys they are of the lowdensity lipoprotein lineage so you've heard the term LDL and HDL what is it referring to it's basically referring to the relative concentrations of protein and lipids in the lipoproteins and not surprisingly based on their names the hds are higher density more protein less lipid the ldls low density lipoproteins and vldls very low density lipoproteins and idls Inter intermediate density lipoproteins are all lower

00:41:28 density which means more lipid to protein there're different sizes there's a whole bunch of other things going on most important fact in all of this is that the apobs are atherogenic so what we're about to talk about next is perpetuated by lipoproteins that have an apob on them so everything in the story right now is just about how do you get cholesterol around the body and these um proteins that have lipid in the middle um so let's just take apob for example um many many billions of them floating around in our

00:42:07 body even in the healthiest of people y um and they're being shuttled to tissues that need them um like the adrenals muscle heart Etc what sets the demand for these things so for instance could somebody have Rel relatively High um LDL maybe even higher than um sort of highend of chart or even um above high-end apob but there's some sort of demand metabolic demand or or there they're weight training a lot or they're running marathons and so they need a lot of LDL the reason I asked this um is because

00:42:52 it's so easy for the uninformed person which I include myself in that group to just hear oh LDL bad cholesterol bad apob bad when in fact um you very graciously spelled out the fact that they these things actually perform a functional role in the healthy body so before we get into why they are or can be bad why would you want a lowdensity Lial protein what is that doing for somebody and is there um any circumstance where the way people are exercising or thinking or not sleeping or or sleeping too much it's um that a

00:43:29 higher level actually reflects a healthy metabolic need we don't have any evidence of that to date um all of the functions that I described can be function can be done by the HDL so the high density lipoproteins the APO as can do all of it so APO and low density lipoproteins are just um they're just the necessary uh we don't no we don't understand why we have them Andrew this is

the part that's really interesting to me um most species do not even have apob and as a result of that most species are chemically incapable of

00:44:12 atherosclerosis so if someone could zero out their apob and their LDL we assume they would function just fine we know they would because we have certain people who walk around with genetic mutations that render them that way wow furthermore we also know that there's a bit of a myth out there that cholesterol the cholesterol you measure in your blood is essential for brain health for example that's an understandable thing right you you can speak to this very eloquently the role of cholesterol in the brain yeah I wrote

00:44:42 down when I um was a postto at Stanford um as I always point out I was born at Stanford trained at Stanford work I'll probably die at Stanford hopefully a long time from now you'll tell me how long we're going to do the Charli we're going to do the Charlie Munger thing and make sure that you never go back to Stanford so that like you can't die there there exactly we cured already um the when I was a postc I worked with a guy named Ben Baris who I I know um you know probably um as a different

00:45:10 person then for reasons that people can look up Ben's name um anyway incredible scientist and but there was someone in his lab that discovered that cholesterol is a critical component of the synaptogenesis process the for the formation of connections between neurons and the developing brain and then that went went on to lead to the discovery of things like um thrombospondin being important for synaptic Genesis Etc but cholesterol sit Central in the brain development mechanisms like you want cholesterol around for brain development

00:45:41 in fact I think very lowfat diets and very low cholesterol diets during early development can really impair brain development as I understand yeah it's not it's not entirely clear why but here's what we know when you're born your serum cholesterol levels are very low so children infants and children have very low levels of cholesterol they would have uh and I should explain one thing that's important they're not melinated yet right I mean they're they're sorry to interrupt but milin of course the the sheathing around uh

00:46:12 neuron neuronal axons which accelerates the propagation of nerve signals and which is deficient in things like multiple sclerosis is essentially fat made up of phospholipid um and requires cholesterol for synthesis but but young children are not very well m i mean the spinal cord is M you know spinal tracks are so this is what's interesting right we would all agree that cholesterol is more important to infants and children than to anybody else right it would be the most important substrate for CNS

00:46:42 development and yet infants and children have virtually unmeasurable levels of cholesterol it really starts to take off in your teenage years right so cholesterol basically serum cholesterol levels rise basically monotonically throughout life um women get a big bump at menopause so it really goes up for them um but what's interesting is how is it how do we reconcile the fact that infants and children have really low levels of serum cholesterol yet clearly undergo CNS maturation without any problems and it

00:47:20 basically comes down to the following what you measure in the serum is but a fraction of the total body pool of cholesterol so we get a little bit of the light under the you know the uh what's the the you know the the Street Lamp under the the drunk under drunk the Street Lamp problem just because we're looking there we tend to think that that's what we're seeing but um if you took the entire circulatory pool of cholesterol it's about 10% of your total body cholesterol it's a tiny fraction of it so it's what we measure because

00:47:52 that's all we have access to but it really represents virtually none of it um I do want want to say something because you mentioned LDL I want to tie this back to the reader right or The Listener rather um apob refers to the lipoprotein the singular lipoprotein wrapped around an LDL particle so if you happen to be lucky enough that your doctor measures an apob level it's a blood test it says apob X number of milligrams per deciliter that's measuring the concentration of that protein it is a direct measurement

00:48:28 of the concentration of LDL and vldl particles when you have a blood test that says LDL it usually doesn't say LDL it usually says ldlc or LDL cholesterol because LDL is not a laboratory measurement LDL cholesterol is a laboratory measurement and it's just taking the total number of LDL particles breaking them apart and measuring how much cholesterol is in them so ldlc measures the total concentration of cholesterol in the ldl's apob measures the number of them and they're different but one of them is far superior at

00:49:07 predicting risk in its apob the number of particles is much more predictive of risk than the amount of cholesterol contained within them fascinating first time I've understood H LDL and these lipoproteins in a way that makes sense so thank you I'm sure others feel the same way what apob level is your red flag cut off right um I actually had my apob measured recently and I'm definitely above the high end we'll be discussing this over dinner on Saturday man and with um and just to tie this back um I hope that's a

00:49:46 steak dinner and that should be fine given the fact that dietary cholesterol has no direct link to apob and L that's true but dietary saturated fat does ah okay so which is not to say we're not going to have a steak will but not necessarily one of the fattier cuts um although probably will be uh for me um so what's what's the high-end that you uh high-end flag at what point you start

saying ah we need to do something and then we'll talk about what people can do yeah so this is a complicated question

00:50:15 because it depends on so many factors the first Factor it depends on is what is your objective and I do pose this question directly to a patient right so I say look we've got this disease it's the number one cause of death now you can die with it or you can die from it that those are your choices statistically speaking more people will die from it than anything else but if you live long enough we will all die with it to some extent so if you're me and I come from a family history as you know I write about

00:50:49 this in the book where basically every man in my family except one has died of atherosclerosis and they have all done so very prematurely uh my dad lost Brothers in their 40s and 50s um by some miracle my dad is still alive at 86 but you know I think that's in large part because he at least had the good sense to listen to doctors and take medication to lower his cholesterol and blood pressure um if your objective is to not die from heart disease and only to die with it then you want apob as low as

00:51:26 possible now how low you go depends on when you start because one way to think about this is it's an area under the curve problem the longer you wait to start doing something about this the more aggressively you need to do something about it um I think a better way to think about this though is to go back to what we talked about with smoking so would you agree that smoking is causally related to lung cancer yes so just to be clear Andrew you do not think that it's just an association that smokers get more lung

00:52:08 cancer no I do not you in other words you believe that smoking causes lung cancer then yes okay I mean there are a number of mechanistic steps in between I mean if somebody was really wanting get uh to you know drill into the logic they could say okay it's not actually the smoking it's a you know some uh uh disruption of the endothelial cell lining that you know smoking triggers that that triggers that I assume so and I agree with you by the way I think the data are very clear I'm very relieved to

00:52:36 hear yeah so but but I'm going someplace very important here because if there's one topic that doesn't get enough attention in medicine it's causality and causality is an obsession of mine like most of the day on some level I sit around thinking about causality and I think the hardest part about studying medicine with respect to human beings is how difficult it is to infer causality for most things that we do so if you believe that smoking is causally related to lung cancer then smoking cessation reduces

00:53:24 the probability of lung cancer that is that is a logical equivalency there can be no debate about that what if I said to you Andrew this is going to be our new philosophy around smoking cessation you're I'm going to anoint you the Zar of smoking cessation so um if people pick up smoking no problem we're going to let them smoke but we're going to assess their risk for lung cancer using a model that predicts when they t 10e risk of lung cancer gets above a certain level we're going to recommend that they stop smoking so we're going to

00:54:03 look at their age their sex their family history some biomarkers that might help us we're going to even do scans of their lungs and once we think they cross a threshold where their risk of lung cancer is high enough let's just say it's 25% boom you make them stop you tell them it's time to stop is that a logical approach to treating smoking and lung cancer or would be better to say given that we know cigarettes are causally related to this how about you never start smoking and the minute you do we pull the cigarette out of your

00:54:37 mouth and explain to you that you're doing something that is causally related of course it would be the latter not the former it would be idiotic to suggest that we endorse smoking until you cross a certain threshold well this now becomes the Germaine question there is no ambiguity that a OB is causally related to atherosclerosis you know how how can I tell you that I can tell you that looking at all of the clinical trial literature all of the epidemic epidemiologic literature and perhaps even most importantly the mandelian

00:55:13 randomizations all of these things tell us because by the way melan randomizations meaning genetic mutants humans out there that make very little apob or excessive exactly so we have a whole gradient so you can say if you make very little you aren't gonna die as uh quickly in your life as if you make too much that's right so mallion randomization is such an elegant tool where you basically let genes do the randomization and as you said there is a gradation of LDL concentration or apob concentration that occurs from insanely

00:55:45 low to insanely high and this is a wildly polygenic polymorphic set of conditions and we can look at the outcomes of those people based on the random sorting of those genes and there's no ambiguity LDL is causally related LDL cholesterol or apob causally related to atherosclerosis well if that's true and I haven't seen a credible argument that it's not there are people who argue that it's not by the way but they just don't have credibility in their arguments then you have to say that what we're

00:56:21 doing in medicine today is very backwards because what we're doing in medicine today is the following we're saying I'm I'm coming at this in a long way but your question is so important that I want to answer it this way we're answering your question today as follows we're saying Andrew let's do a 10-year risk calculation of your risk of Mace mace stands for major adverse

cardiac event it is the metric we use in medicine so major adverse cardiac event is a heart attack stroke you know or death basically resulting from these things so

00:56:56 and we have calculators that are pretty good at predicting your 10year event risk they'll look at your cholesterol levels your blood pressure they'll ask if you smoke they'll ask some family history questions and they'll spit out a number now we should do yours after the fact um and I don't know if we did it for a person who's is you know you're in your mid-40s like it would probably spit out less than 5% risk for a major adverse cardiac event in the next 10 years in fact the models don't even work

00:57:31 if age is below 40 so the first time I went to do one of these tests when I was in my mid-30s I couldn't do it like the the algorithm breaks that's sort of like uh you know just doesn't work so the the implication there is if your uh if your mace risk is less than 5% the thinking is you do not need to treat LDL or apob I argue that that makes absolutely no sense it's just as idiotic as the analogy I used around smoking if a risk is causal and it is modifiable it should be modified regardless of the risk Tale

00:58:12 in duration so then the question becomes to what level and again the earlier you start the less aggressive you need to be the less damage that's there already so for example we do CT angiograms on our patients if the CT angiogram shows no evidence of calcification no evidence of soft plaque that means grossly their coronary arteries are still normal histologically they're probably not because nobody probably makes it to our age with histologically perfect coronary arteries you know we might be satisfied

00:58:45 with a person's apob being at the fifth percentile of the population which would be about 60 milligrams per deciliter but if we have any other factors meaning we're starting later in life you know or a person already has gross evidence of disease calcification soft plaque family history is significant any other risk factors are present I mean we'll we'll treat apob to 30 to 40 milligrams per deciliter which is you know probably the first percentile and if somebody's sitting up in the say low 130s um what where does

00:59:20 that what kind of flag does that raise for you and I realize it's highly contextual age Etc no no it's a huge red flag again um just because something is causal doesn't mean it's you're guaranteed to get it there are smokers who don't get lung cancer so you know there's going to be somebody listening to this who says my my grandmother's 95 years old she's as her cholesterol is Skyhigh and she's alive and well and I will say absolutely there are a lot of people walking around that way just as there are a lot of smokers walking

00:59:48 around who don't get lung cancer um you you can't you can't impute these things on an individual ual basis you basically have to ask the question um how do I make the best judgment about an individual from heterogeneous population data and based on what are causal and non-causal inferences around risk so you know to me if a person has very high apob and they do not want to be treated for it then the best we would do is say let's at least establish that there are no other risk factors present and let's

01:00:27 at least do the most investigation we can around the existing damage and if that person has a perfect CT angiogram I'm going to push less hard than if they have a devastating angiogram and by the way devastating in my book is just any amount of calcification or soft plaque anything that shows up grossly that you can see on a CT scan means that you've got a decade plus of really bad histology building up to it this uh issue of causality I think now becomes very clear as to why that is so crucial and um

01:01:03 really appreciate the way you spelled that out so let's say somebody's apob is you know 80 100 let's say 130 um for example what sorts of things can they do to reduce that number is this always going to be prescription medication and if so what are the more common forms of prescription medication that work best what are their side effect Prof profiles and so on so yeah usually once you want to start getting down into the 30 to 60 range you're going to require pharmacotherapy um but you know usually

01:01:37 we want to see how far we can get with nutrition so fixing insulin resistance in an insulin resistant person will will bring this down right so one of the Hallmarks of insulin resistance is elevated triglycerides they haven't we haven't talked about triglycerides but they they warrant some attention because I mentioned it earlier but one of the other things that the lipoproteins carry is triglycerides so they're they're carrying fat and cholesterol and if you recall APO represents the number of particles so

01:02:11 the purpose of them is to be carrying around mostly cholesterol but if you have a high amount of triglyceride you're basically using up cargo space on the ships and so you need more ships so if a person has elevated triglycerides and I consider anything over 100 to be elevated even though most laboratory tests would consider normal to be up to 150 milligrams per deciliter um we would want to fix their insulin resistance bring the trigs way down uh I I would want to see trigs no more than two times

01:02:44 the HDL cholesterol so if your HDL cholesterol is you know 60 milligrams per de I consider 120 to be through the roof high and ideally we want trigs at or below HDL cholesterol being triglyceride right so and uh mean lowering dietary fat no actually it's most easily accomplished through carbohydrate restriction yeah carbohydrate triglycerides in some ways are

kind of an integral of carbohydrate consumption um any energy restriction will get it for you um but it's most sensitive to um to restriction of of um

01:03:22 even even under UK caloric conditions carbohydrate restriction will lower triglycerides so again energy restriction would be kind of first order of business um but within that carbohydrate restriction will probably get you there quicker so you know you want to take the the lwh hanging fruit off the table and where does exercise come um play a role minimal role for improving insulin sensitivity no no no no I'm sorry for improving uh lipids in general yeah but it can improve in uh absolutely especially combinations of

01:03:53 resistance training and cardiovascular exercise correct yeah so once it comes down to pharmacotherapy um you basically have several classes of drugs so the most obvious and the one that most people are aware of are called statins so statins work um both directly and indirectly on the problem so directly they work by targeting an enzyme um very high in the synthetic pathway of cholesterol production enzyme is called HMG COA reductase and I think it's the second committed step I might I could be wrong on that it's I don't

01:04:24 think it's the first committed step but but you that that enzyme gets targeted kind of ubiquitously throughout the body and in response to that the liver senses a reduction in the body's pool of cholesterol and the liver really tries to regulate this so the liver in response to that increases its expression of LDL receptors so the liver itself has LDL receptors on its surface and as the body's pool of cholesterol goes down the liver senses this reduction and says I want to bring more chol ol in more LDL receptors go up and

01:04:59 more apob particles are coming out of circulation so that's really the dominant way that they work and in fact that's kind of the dominant way that all of these drugs work so another class of drug is called aetam it works by blocking we could get as technical as you want on this it's called the Neiman pix C1 like one transporter in the entros site um I like to explain this I borrow this explanation from Tom dpring but the entos site is a is obvious see the luminal gut side cell that is responsible for absorption of

01:05:32 cholesterol remember I said earlier most the cholesterol you eat you don't absorb the reason you can't absorb it is an esterified cholesterol molecule cannot come in the Neiman pixie1 like one transporter it's too it's physically too large but the cholesterol that you synthesize which once it makes its way back to the liver gets secreted in bile down the intestine that is unesterified and readily fits into that transporter so I kind of describe that guy as the ticket taker at the bar he lets everybody in as long as they fit through

01:06:04 the door there's a checkpoint inside the bar that basically says do we have too much cholesterol if so spit it out and there's another door that acts more like The Bouncer and he's called the ATP binding cassette G5 G8 and he spits excess cholesterol out and if that system is working fine everything is great but in a lot of people that ATP binding cassette doesn't work very well and it can't properly regulate the total body pool of cholesterol so there's a drug called aetam that simply blocks the

01:06:32 ticket taker are there side effects to statins and a zami aetam has virtually no side effects it's a you can think of it as a drug that's acting outside the body right it's sort of acting on a you know a Turn Style door in your gut um I have seen one patient get uh sort of loose stools from it that became enough of an issue that we discontinued it um I would say that when zami is combined with a Statin which is very commonly done um it's not unheard of I don't I can't give you a number but it could be

01:07:07 as high as 10% that you see an elevation in transaminases which are enzymes that are made by the liver in response to some irritation so you know this is where I think it's unclear what the clinical significance of that is we tend to abort the strategy in the presence of elevated transaminases um even though the literature says you don't need to our view is we have other options why would we tolerate any inflammation if you don't need to statins uh do have side effects so 5% of people genuinely and

01:07:38 legitimately legitimately get a muscle soreness uh that can be debilitating it could feel like kind of the worst workout you've ever had that you know like the day after you've like imagine you hadn't lifted weights in 6 months and then you you know came over and I made you do the most brutal workout of your life you know how you would feel that happens every time I come over to well I work out often um but every time I come over to your house you put me through the most brutal workout I've ever been through I think you and cam

01:08:05 Haynes are the two people who've managed to put me through workouts that kept me sore for at least uh two weeks after each visit so so that soreness that imagine you would have that persisting that 5% of people get that response from a statin and obviously that's just non you know it's a non it's a non it's a non um there's a narrower subset of people that um do do do get brain fog and do experience brain frog from statins and and we don't really understand the why there we have some theories as to why you know maybe

01:08:37 they're maybe they're getting too much of a reduction in central cholesterol synthesis um again it's a subjective finding but given that we have so many tools in the toolkit like we don't have to tolerate side effects with these drugs anymore there was a day when you know you had somebody who just had a heart attack and they're basically looking down the barrel of being on

a statin for the rest of their life and there were like two of them and they you know had tons of side effects and it it didn't matter

01:09:05 today while there were probably nine statins out there there were really only four that we even use and at least two of them have such a low side effect profile they're not as potent but they have a I mean potent a bit of the potent the wrong word they don't have the same effect um but they're very potent because you're at least one of them you're taking at such a low dose um that we've got lots of Statin options the third side effect of statins which again not common but can't be ignored is insulin

01:09:36 resistance so it really and this is one of the I think one of the benefits of at least having periodic CGM tracking is we'll see this you know we had a patient who happened to be wearing CGM in general and then we started him on you know 10 milligrams of rza Statin which is probably the Workhorse Statin right now it's a that's generic NM for store um and he pings us like a couple weeks later and he's like man my glucose is like 10 points up consistently from where it has normally been kind of hummed and haod we troubleshooted a few

01:10:09 things after two months we're like let's just stop the Crestor and uh see if that fixes it and it immediately fixed it so there was you know we reintroduced the Crestor and it happened again so there was no doubt in my mind that you know or low doubt in my mind that Crestor was responsible for that um and again you could say well maybe that's not that clinically significant but I would argue why bother I have other choices so those are your two big ones um the next one that is really the big one are pcsk9

01:10:35 Inhibitors so you know um gosh we're coming up about 20 years ago maybe a woman named Helen Hobbs uh made a discovery of a group of people that had a disease called familial hypercholesterolemia so FH or familial hypercholesterolemia is a very genetic heterogeneous condition going back to that mallan randomization study these are the people on the far end that show us how high lipid levels cause atherosclerosis so these people have very high cholesterol levels typically north of 300 milligrams per deciliter

01:11:09 their LDL cholesterol alone is by definition at least 190 milligrams per deciliter uh very high incidence of atherosclerosis in these people along with other sort of injuries like they accum they have so much cholesterol they accumulate it in their tendons in their eyes I mean it's it's it's really devastating condition if not managed correctly and she discovered this mutation in uh a gene for pcsk9 that codes for a protein that degrades LDL receptors so these people had hyperfunctioning pcsk9 genes so their

01:11:44 genes were just chopping down all the LDL receptors in the liver so these people weren't clearing LDL about 5 years later another subset of the population were discovered that we the exact OPP opposite these people had hypofunctioning pcsk9 they had virtually unmeasurable these people had LDL cholesterol levels of 10 to 20 milligrams per deciliter and not surprisingly they had no heart disease so that led to the development of a couple of amazing drugs that are now used so I take one of these drugs I've

01:12:13 been taking one of these drugs for I don't I probably started in 2015 so it's an injectable drug I take it every two weeks and it's a called a pcsk9 inhibitor so the drug blocks the protein and therefore gives me more LDL receptors Yanks more apob out of circulation interesting when we were talking about side effects I um I was thinking are there any short-term benefits so I guess we call this positive side effects but let's think of it more directly in line with the underlying biology let's say my apob is

01:12:46 um High mid-range to to high you know let's say 100 um you know 80 to 100 um and I improve my insulin resistance through nutrition but we decide you know it doesn't go down so much so we're going to continue to to try and knock this number down and and I take uh any number of different drugs um to reduce it do I immediately start to feel better nope so there's no feel okay you feel nothing and I think that's an important um important point because of the causality issue that we were talking about earlier because a lot of people

01:13:21 are walking around out there feeling fine their apob might be a bit high they either know it or don't know it but they think well I'm feeling fine and you gave a very rational argument earlier as to why because of the causality involved it makes far more sense to intervene yeah we don't want to rely on feeling when it comes to atherosclerosis just to put some perspective on this when I was in medical school we had a I I think I even write about this in the book we had a pathology lecture where the professor

01:13:52 stands up there and he says um what is the most common presentation of a heart attack and you know us Keener first year Med students hands shoot straight up chest pain no that's not the most common uh oh uh uh shoulder pain AR radiating down the left arm no nausea shortness of breath no no no we rattled this off for a few minutes and he goes death the single most common presentation for a myocardial infarction is death more PE now I would say today that was 25 years ago today it's probably not the most common

01:14:33 because um Advanced cardiac life support is so much better but it's still strikingly common so well you could say that um the the best predictor of a heart attack is still a heart attack um I not saying that the best underlying predictor but um and actually this hits home when I was uh postto I was living in San Francisco and I'll never forget this taking my coffee and uh out on my

porch in the morning this is right near the UCSF Parnassus campus and this guy's walking down the street he's probably

01:15:01 about my age and I said hello and he said hello he walked a few more steps and boom he just hit the concrete and died right in front of me it took a minute or two to know that he was truly dead I'll never forget it because that's a for a non surgeon you know it's it's an event right and they and I followed up on this and because it's family you know the the whole thing um because they wanted a report and no cocaine in his system no prior history of any kind of health issues and but he was just strolling along and just boom as if he'd

01:15:30 been hit by a bus it's crazy so it's I mean again this is just one of those things where we're g we're gonna spend a lot of time talking about things that feel good and feel bad when you change them right like if you take a person who's not sleeping well but who thinks they're sleeping well and you ask them for a leap of faith which is hey give me a month to help you sleep really well yeah you're going to feel better you might not know it now because you don't know how bad you're sleeping now you've

01:15:55 become acclimated to this U but this is not one of those domains you know exercise nutrition sleep all those things when you do those things better you feel better but I you know I don't want to overpromise on this you're you're not going to feel better in the moment when you fix your lipids but you'll feel better when you don't have a heart attack so by all this logic everybody should get their apob measured how early in life should people do that starting in their 20s uh in their 30s certainly if you

01:16:23 have a family history that is of any concern like in ret like if I could live my life over again knowing if I knew everything you know then that I know today yeah I would have had mine measured in my 20s you know I didn't I didn't get my apob measured for the first time probably till I was in my 40s because you know that's well yeah maybe late 30s early 40s right um I had my first calcium scan when I was 35 and I had to beg borrow steel to get it done because everyone was like why does a 35-year-old want to do this but I

01:16:54 something I just felt something was wrong given my family history um and I'm glad I did I'm glad I did that because I learned something that that completely changed the direction of my life okay I know my apob numbers and it I might be that guy who's up in the you know above a hundred so I'm going to get this treated uh that's a promise to myself I'd like to just take a brief moment and thank one of our podcast sponsors which is insid tracker insid tracker is a personalized nutrition platform that

01:17:20 analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work done for the simple reason that blood work is the only way that you can monitor the markers such as hormone markers lipids metabolic factors Etc that impact your immediate and long-term Health one major challenge with blood work however is that most of the time it does not come back with any information about what to do in order to move the

01:17:46 values for hormones metabolic factors lipids Etc into the ranges that you want with insid tracker changing those values becomes very straightforward because it has a personalized dashboard that you can use to address the nutrition-based behavior-based supplement based approaches that you can use in order to move those values into the ranges that are optimal for you Your vitality and your longevity inside tracker now includes a measurement of APO lipoprotein B so-call apob in their ultimate plan apob is a key marker of

01:18:14 cardiovascular health and therefore there's extreme value to knowing your apob levels if you'd like to try insid tracker you can go to insid tracker.com huberman to get 20% off any of insid tracker plans again that's insidetracker docomond to get 20% off we covered um the three major risk factors which were um blood pressure um keeping that in check don't smoke um and apob and we've now talked about the things to adjust apob levels we did not really talk about things to adjust blood pressure I'm

01:18:48 assuming exercise sits as one of the for exercise nutrition yeah weight weight management is a huge one here so you know you take a person who's blood and and this is one of those things where we don't immediately jump on the pharmacotherapy train with blood pressure um because here there are side effects sometimes um and you do have to worry about overshooting you don't really have to worry about overshooting a person's lipids we do back off if we overshoot but it doesn't cause a symptom there's

01:19:13 not a there's not a short-term immediate risk from doing that if you overshoot somebody's blood pressure medication you trade one problem for another problem they become laded when they get up to pee at night they fall and bang their head that's a devastating consequence totally unacceptable so our goal is to see how much we can lower blood pressure without medication before we turn to medication and let's be clear the meds today are so much better than they used to be again there was a day when the

01:19:40 side effects of these medicines were miserable that's that's simply not the case today I mean ACE inhibitors Angiotensin receptor blockers I mean these things are very well tolerated especially the arbs um so again almost anybody can on these things but if we could get a person to lose 10 pounds and exercise every day we see great effects with zone two stuff right so

kind of the low intensity cardio what's and your recommendation there I know you talk about this in the book but we I've thrown out numbers about 15 to 180

01:20:12 minutes per week you go a bit higher yeah we go 180 to 250 240 yeah I'd like to see three to four hours a week of zone two um so that's an important piece and sleep is an important piece um so get get the sleep right get the exercise right if you if you're if you're overnourished let's correct that problem and if all of that doesn't work and by the way that works a lot of the time works most of the time if that doesn't work then we've got pharmacotherapy there is still a true phenomenon of essential hypertension which is in

01:20:42 individuals for whom all the fixable stuff has been fixed and they still have high blood pressure uh we still have to medicate those Folks by the way there's something that I want to mention here that doesn't get much attention but it's so important which is the effec of high blood pressure on the kidney and also the brain itself we've talked about the brain we've talked about the heart but the kidney doesn't get enough attention the the kidney is a remarkable organ and I think if you're really in this game of

01:21:09 trying to live longer right if you if you think hey you know maybe we'll live 80 85 years but if we kind of start doing all of these other things and and really optimizing our behaviors that could be 95 well you have to start thinking about the capacity the kidney and once the glomular filtration rate Falls below a certain level uh you have to be very careful with how you live your life and unfortunately this is one of those things that I is is another sort of mistake that's made in kind of modern

01:21:42 medicine which is we don't pay enough attention to how to measure kidney function correctly we rely very heavily on something called um creatinin as opposed to looking at another biomarker called catin C Which is far more accurate and also tolerate too low of a kidney function for a person's age so we look at you know we might look at someone who's 50 who's kidney function is at 65% and say you're totally fine because it's true that at 65% there is no problem but you're not thinking well if this person has to live another 40 years

01:22:14 and this continues to go down they're going to potentially be staring down the barrel of needing dialysis The Last 5 Years of their life again you don't want you want to die with with compromised kidney function but never from compromised kidney function in fact the hazard ratio of all cause mortality associated with compromised kidney function is even greater than that of heart disease once once you cross that threshold I mean lights out once you are needing dialysis I mean your risk of death is

01:22:45 higher than that of someone with high blood pressure smoking even someone who has cancer you have a higher risk of death having endstage renal disease than you do having cancer so um the kidney is so sensitive to blood pressure this is a tiny organ that on every pump of your heart is getting 20 to 25% of your blood wow so just imagine how sensitive and susceptible it is to elevated blood pressure we've covered um quite a few corners of avoiding the major killer atherosclerosis um let's talk about

01:23:22 cancer nobody wants cancer everybody seems to know somebody who has had or has died of cancer and probably no surprise given that it's number two on the list what are the numbers and what can people do to offset cancer um and of course can't there are huge number of different types of cancer um and inside of this conversation I just want to um earmark that might be good to have a conversation about alcohol which we didn't talk about in the the last um last discussion but if alcohol is involved or is a risk factor rather for

01:24:01 cardiovascular disease or cerebrovascular disease now would probably be the time to to mention it yeah um this has been looked at in a number of ways um and you know so if you if you look at sort of Topline epidemiology and you you've heard of these things called the French paradox which is oh come on like they eat all of this fatty stuff and drink all this wine and they have a slightly lower risk of cardiovascular disease you just have to kind of throw that stuff out the window because there's so

01:24:27 many confounders there that it's kind of useless epidemiology if you really look at the data clearly and there was actually a really elegant analysis that included some genetic studies that came out in jamama about a year ago it's actually pretty clear that there is no dose of ethanol that is healthy okay so there's no J curve so it used to there used to be kind of this literature that said there's a J curve associated with ethanol so meaning um at at total abstinence there's a slightly higher risk of death than if you're

01:25:02 drinking one drink a day and then if you go beyond one drink a day the W the rate of death starts to climb the problem with that analysis so there just been a lot of consternation around that but the problem with those analyses are multiple but the most important of these are that the abstainers have a reason for abstaining typically and those reasons can can't be extracted statistically from these analyses so I'll leave it at that without I mean I've written many blog posts about this if people are really

01:25:34 interested um they can they can go and talk about that I also do talk about this a little bit in the book by the way um but the the short answer is there is no dose of ethanol that is healthy I would argue that it's not a straight line of risk but it probably goes I think from zero to one there's probably no measurable harm for most people one per day or one per week probably one

per day up to one per day it's probably very difficult to discern the harm but I'm going to put a caveat on that that I'll

01:26:05 come back to and then I think the risk starts to climb pretty steeply after that and I think it climbs nonlinearly after that that that is my reading of the literature okay so then how do you decide if you're going to have up to one drink a day and by the way that's not the same as seven a week because that doesn't mean seven in a day right which we know is is really detrimental right for especially for the brain right but also the Cascades that result from uh disrupted sleep not just for that one

01:26:36 night but multiple nights yeah yeah the the literature I've seen on alcohol you know that the most now again this is an emerging literature because um what you're describing is exactly right but people are now some more conservative folks are starting to place it at two drinks per week total Beyond which you start running into issues especially for women in terms of breast cancer risk which is something maybe we can we can Circle back I mean look my view is if you can not drink at all you're better

01:27:05 off not drinking at all and people always say to me well Peter what's your view on this and my view is I do drink um I'll go weeks at a time without having a drink I haven't had a drink you know I've had one drink since I saw you last a couple weeks ago because I've been sick so I'm thinking well gosh like the deck is stacked against me right now why would I do anything to stack it more um but my philosophy which is half tongue and cheek but is is true is like I just don't drink bad alcohol you know I I sort of my wife saw

01:27:37 me do this the other day we opened up a bottle of wine and it was a very expensive bottle of wine and I took a sip and I was like yeah I just dumped my glass I was like I don't know just doesn't taste right to me uh and it tasted fine to her so I don't think it was that the wine had spoiled it was just I didn't like the taste of it enough to justify drinking it I was like I don't feel like drinking it yeah I've fortunate I there were times in life you know certainly college and portions of graduate school when I drank but I've

01:27:59 never really enjoyed the the um taste or experience of alcohol so I all the alcohol in the pl could disappear I wouldn't even notice but I'll have one every once in a while I'm sort of of that of that mindset but um great to hear that zero is better than any um because I think everyone agrees on that um so it doesn't appear that alcohol can be directly linked to cardiovascular disease and cerebral vascular disease although there are these indirect effects through insulin altering insulin sensitivity S I think I think the the

01:28:31 impact of sleep on cardiovascular disease is profound and I do think that the impact of ethanol on sleep is underappreciated yeah and here I think we should um do a little uh nod to Matt Walker the great Matt Walker because you know 10 years ago if um we someone had a conversation about sleep and how critical it is and how not getting enough quality sleep is dangerous people would have just kind of shake their heads and say what's the evidence for that I think Matt really deserves um most of the credit for

01:29:03 alerting people to these issues around not getting enough sleep it's just remarkable what's happened in the last decade thanks to Matt and while we're on that topic we you know we have the other next Horseman of death the neurodegenerative diseases I think those were also heavily impacted especially on the dementia side uh by ethanol so again I want to be careful when I say this stuff right I don't believe in fear mongery okay I you know I just said a moment ago I'll say it again I drink

01:29:29 alcohol and I'm going to continue to drink alcohol but I think that one has to make the trade-offs which is like if I really do love the taste of certain Spanish wines I really do love the taste of certain Tequilas certain mcs and I really do love the the taste of certain weird esoteric Belgian beers and it really does give me pleasure to consume those things in the same way it gives me pleasure to consum certain foods that are quite vapid right you know there's no upside in consuming a brownie that my

01:30:03 kid just made except for the fact that my kid just made it and it's fun to eat the brownie with them right so you know we come back to this thing about like longevity is also about health span and part of Health span is quality of life and you know I write about this in the book that I think there was a day when my approach to this was purely an engineering approach which was we going to optimize every molecule of my being for this and if you if you go so far down that rabbit hole that the quality of your life deteriorates

01:30:38 what's the point so that's why I think for somebody like you who says like you could take all the alcohol off the face of the earth I wouldn't even notice then that's a great reason not to bother drinking I wouldn't put myself at the opposite end of that Spectrum but I'm probably further to the Spectrum you know where yeah if you told me I could never drink alcohol again I would be fine with it but I'd be giving something up that I enjoy um but at the same time I know if I have two drinks with dinner my sleep

01:31:08 sucks and therefore that's that's just a threshold I rarely rarely cross I certainly have my vice as alcohol just doesn't happen to be one of them what about cancer again nobody wants cancer uh we've all known people have died of cancer um or have had cancer what can be done to reduce one's risk of cancer well you asked earlier about the numbers so let's throw some numbers

out there right so globally we're talking about 11 12 million deaths per year about half the number of uh ascvd still a staggering number um at the individual

01:31:48 level put it this way somewhere between 1 and three and one and four chance anyone listening to this or watching is going to get cancer in their lifetime but what's the probability they will die from that that about a one in six chance of dying okay so is it true that every male gets prostate cancer most in other words on their death bed every man will die with prostate cancer and some will die from it got you you and I have prostate cancer right now thank you for informing me yes uh hopefully we will not die of

01:32:20 it we should not die of it prostate cancer colon cancer are Cancers that no one should ever die from because they are so easy to screen for they are so easy to treat when they are in their infancy um that it's totally unacceptable that people are dying from this there are other cancers for which I can't really say that breast cancer much more complicated pancreatic cancer much more complicated gasto multiform much more complicated so there you know as you said a second ago cancer is not a disease it is a category of diseases

01:32:49 each it's not just that each organ is different and breast differs from pancreatic it's that within breast cancer erpr positive her two new positive is a totally different disease from the triple negative breast cancers those with braam mutations or non- braam mutations well even putting that aside just looking at the the hormone profile of the individual breast cancers they're totally different diseases so it's not just that breast cancer is different from prostate cancer it's that all breast cancers are quite different maybe

01:33:18 I should frame the question a little differently than given the vast number of different types of cancers and categories Within your question is still a fair one I just wanted to throw that caveat out there so now to your question okay so what do we know it turns out that we can very comfortably speak to um several things one is the role that genes play so um maybe I'll just spend one second on a gene 101 thing for for the for the viewer we want to differentiate between what are called germline mutations and sematic mutations

01:33:54 so um your germ line and my germ line are set when we were born our germ line mutations uh any mutations we have in germline genes are inherited from our parents it they're non-negotiable non-negotiable you got those things so question one is how much of cancer results from those types of genetic mutations and the answer is very little less than 5% so very now you mentioned one a moment ago braa okay so so mutations in braa are germline mutations a woman will get a braa mutation from one of her parents and we will often

01:34:35 have a sense of that just from the family history you know when mom and sister and aunt and grandmother had breast cancer you've got a breast cancer Gene now it might be braa it might be another Gene that's not braa but there's no ambiguity and we test for these genes mostly just for insurance purposes frankly but there's no ambiguity that that was a germline transmission of a gene that is driving cancer but 95 plus percent of cancers are not arising from germline mutations they are arising from sematic mutations

01:35:11 or acquired mutations so the question then becomes what is driving sematic mutation and the two clearest indications of drivers of sematic mutation are smoking and obesity smoking we've talked about let's put that aside for a moment I'm so surprised about obesity I don't know why I'm surprised but I've um never heard this I'm probably just naive to the literature yeah so obesity is now the second most prevalent environmental driver of cancer now I will argue and I think I argue this in the book hopefully

01:35:50 pretty convincingly I don't think it's obesity per se I think obesity is just a masquerading proxy what is obesity obesity simply is defined by body mass index well first of all uh I don't think I'm obese but I'm I'm way overweight on BMI you probably are too so you know let's just acknowledge I'm clinically diagnosable as obese are you oh no well not well clinically BMI over 30 I don't think you're probably there no but if I if if I measure my weight by height um you know my BMI is probably 27 or 28

01:36:24 okay it's been a little while since I've checked I I can I only know body fat percentages and things like that so so so basically like BMI is a far from perfect proxy but at the population level it's what we use um I wish we would get off it by the way I think it's really crap because it doesn't take into account lean versus I think we could get I think we could get better data if we looked at waste to height ratio that's a way better metric so this is just a quick test for everybody it's I don't I I'm

01:36:54 going to argue your BMI is less relevant to me than your eye color but if your waist circumference is more than 50% of your height you should be concerned okay well then I'm okay yeah you're fine by that metric right but that's important so if you're six feet tall your waist better be under 36 in and if it's over I would argue that's the definition of obesity not your BMI being over 30 so um back back to this issue because we're using such a crude measurement it basically is catching a whole bunch of

01:37:30 stuff but the question is what's driving it and I think if you really look at the physiology of cancer I don't think it's obesity I think it's two things that come with obesity insulin resistance which is you know 2/3 to 3/4 of obese individuals are insulin resistant and inflammation and I think those two things with the inflammation and the immune dysfunction with the insulin

resistance and the hyper basically tonic growth stimulus that's coming that's what's driving cancer so again is it because a person is storing extra fat

01:38:11 you know and their love handles that that's driving their risk of cancer no that that's those are just two things that are coming along for the ride so beyond those two things and along with C we also certain environmental toxins we absolutely know are doing this right so we understand that people who you know have exposure to asbestos have a much higher risk of certain types of lung Cancers and things like that but for the most part um those are our big risks beyond that we talk about alcohol in certain cases

01:38:39 absolutely um alcohol is a carcinogen um it's the dose part still isn't clear to me I don't know is one drink a day moving the needle much on cancer risk per se it's not clear and it might depend on those uh genetic predispositions yes so so yeah if Step One is don't get cancer you have no control over your genes you have control over smoking you have control over insulin sensitivity I wish I could sit here and tell you that there is a proven anti-cancer diet or that if you do x amount of exercise per

01:39:24 weak you're going to not get cancer we just don't have a fraction of the control over cancer that we have with cardiovascular disease we we don't understand the disease well enough so we don't understand kind of the initiation process and the propagation process um and we you know we we have to rely much more on screening are there good whole body screens for cancer uh in other words can I walk into a tube and um or a cylinder rather and get screened for the presence of tumors any and everywhere in

01:40:03 the body outside the brain because the brain's a little harder to to get to right believe it or not the brain is actually pretty easy to screen for Zo is so fatty and floating in water well and also the head when you put the head into an MRI scanner there's no movement uh it's the least motion artifact is in the brain so when you use something called diffusion weighted Imaging with background subtraction in an MRI a technology that was actually pioneered in the brain for stroke identification um it's also really good at looking for

01:40:31 tumors as well um so let me make the argument for why screening matters because this is again kind of an area where I go far down a rabbit hole in a way that I think traditional medicine would argue against so my argument for screening is an argument at the individual level and it goes as follows to my knowledge there is not a single example of a cancer that is more effectively treated when the burden of cancer cells in the body is higher than when it is lower uh so the two examples I think I talk about in the book are colon cancer

01:41:13 and breast cancer so when you take an individual with stage four colon cancer that means that the cancer has left the colon and is now outside of the colon so it's usually in the liver at a minimum potentially in the lungs or in the brain that person's five year survival is very low their 10 year survival is zero we will treat them with a very aggressive regimen of multiple drugs and again you'll get a 5 year survival of you know maybe 10 to 20% and by 10 years nobody's alive if you take a person with stage

01:41:51 three colon cancer so the colon cancer is big and it's even in the lymph nodes around the colon but at least grossly you can't see colon cancer cell you can't see those cells in the liver microscopically of course we know they're there because if you don't treat those patients they still die of colon cancer but you whack them with the same chemo regimen that you were going to give the metastatic patients 80% of those people are alive in five years so night and day difference in survival what's the difference in the person with

01:42:24 metastatic cancer you're treating a person with hundreds of billions of cells in the Adent setting which is what we We call we call it adant when you treat people who have only microscopic disease you're you're treating billions of cells the same is true with breast cancer so we have the clinical trial data to put them side by side so rule number one is don't get cancer rule number two is catch cancer as early as possible if you're going to get it which brings us to your question of how do you screen for it um we basically

01:42:57 screen the first line of screening is is Imaging is is is is a sort of visualization so you have cancers that occur outside the body that you can look at directly so skin cancer you can look directly at the skin uh esophageal gastric colon cancer are those are outside the body right mouth to anus embryologically is outside the body so you can put a scope in and you can look directly at the cancer but for all other cancers that are inside the body you have to rely on some sort of Imaging modality um

01:43:26 although now we're starting to look at things things called liquid biopsies so blood tests that are looking for self-free DNA and the self-free DNA gives us a sense of based on the epigenetic signature of what you're looking at hey is there a cancer in the body and if so what tissue is it potentially coming from based on these epigenetic signatures so the problem with relying on any one modality is a is a problem of sensitivity specificity optimization now with MRI scanners which are in some ways

01:43:59 the best way to do this because they don't have radiation so you don't want to be incurring damage as you do this the irony of doing a whole body CT scan to screen for cancer is your you know whole body CT scan would be close to you know 30 to 50 Ms of radiation it's staggering some of radiation so does that mean that people should uh sorry to pull you off this but um I was

going to ask about this anyway avoiding going through the whole body scanner at the airport um
noise Solo solo yeah you know

01:44:32 going through a whole body scanner at the airport or even getting a dexa scan I
mean these are trivial amounts of radiation what about flying you know uh hear that Pilots get more
uh get more pilot if you're a pilot who's flying over the North Pole back and forth and back and forth
you're probably getting you know 5 to 10 m seevers a year the NRC suggests that nobody body
should get more than 50 Ms a year so uh you and I both travel a fair amount uh but typical travel for
the busy person let's say um

01:45:03 two roundtrip flights of uh more than two hours per month and an international trip
every three months um probably still less than a mly seert a year yeah uh living at sea level one m
seert a year living at a mile elevation if you lived in Denver you're at 2 Ms a year Bas I have to ask
standing in front of the microwave I'm just we've got friends they they they ask and with or without
testies on the counter that's an inside joke that uh unfortunately and fortunately deserves no
description um and Peter's not

01:45:37 referring to me um but people worry about other sources of radiation so doesn't
sound like the microwave is a concern um what are the other major sources of radiation um I mean
outside of sort of nuclear stuff where things go sadly live near a plant or there's been a there's uh it's
mostly it's mostly at the hands of medical professionals right it's the CT scanner and the pet
scanner are hands down the biggest source of radiation what about the x-rays of the dentist when
they go when they Scurry

01:46:03 behind the wall put under the blanket they're they're very low uh relatively speaking
uh fluoroscopy is very high um they tend to try to cover up all of you that so for example if if they
were doing a fluoroscopic study of your kidney because you had a stone or if you were getting an
injection into you know if they were doing doing a a fluoroscopic guided injection of one of your
discs in your neck that would be a locally pretty high dose but they're going to cover the hell out of
you elsewhere um and again if if you if you

01:46:33 get one of these things it's not the end of the world but boy I wouldn't want to be
getting one a month and and back to the point about screening you know a a chest abdomen pelvis
CT scan is probably I mean look there's probably a scanner out there now that's moving fast enough
that it's much lower but I'll give you an example okay remember how I talked about we do CT
angiograms on all of our patients for coronary artery disease um an off-the-shelf scanner for this is
20 Ms of radiation okay so

01:47:03 calibrate calibrate me because that's 40% of your annual allotment oh wow so the medical uh practitioners really are the uh the major culprits here that's right so what what we say is and I think most doctors are now realizing this is no no it behooves you to pay a little bit more to go to a really good place that can do that scan for 2 m cevers meaning they have a much faster CT scanner much better software and they're better Engineers so they have better engineering that they can do on the scanner to get that done so so I if for

01:47:40 someone listening to this here's my take do not get a CT scan or any Imaging study without asking how much radiation am I seeing and if a person can't tell you how many MTS of radiation you're being exposed to then just say I'm I'm going to wait a minute until somebody can tell me that I I realize and keep in mind 50 if you know if 50 is the most you should ever be exposed to in a year there better be a damn good reason why I'm going to get 25 in a day now there are some people who have to do

01:48:07 this if you're a cancer patient and they're scanning you as a part of your treatment I mean you know you have to pick and choose between those two those two opportunities so I don't want to I don't also don't want to create some fearmongering where oh my God if you hit 50 in a year your hose no it's just I wouldn't want to hit 50 a year every year for my whole life and I certainly wouldn't want to be hitting hundreds a year for any period of time I think we're just trying to raise awareness and

01:48:32 and also calibrate people to you know what the sources are and and so they make can make good choices not um to place them into a chronic state of fear or even an acute state of fear so for that reason we prefer MRI scanners because there's no radiation I realize this might sound like a specialized circumstance but I'll just start off um with my own which is you know when I was a graduate student I um worked with fixative so paraph Maldives parap Malahide excuse me um glutalide we know that these are

01:49:02 mutagens they mutate cells not good you do some molecular biology in the lab you use DNA intercalating die those little bands and gels the reason they label is because they get between the DNA not good if for to get into your own uh DNA um and that's a very specialized circumstance I also injected Tri radioactive Proline into animals and things of that sort again very specialized and yet most people I think uh will be exposed to pesticides um they'll put um stuff on their lawn or they'll have um paint thinners and

01:49:36 things of that sort is there any sense of what the average if one can average risk um is incurred in terms of carcinogens just through this interaction with um you know weed killers uh paint thinner um detergents around the house that you know we now know there's some major lawsuits that have been uh successful against the the manufacturers of these things um and what

is the real cancer risk created by having those kinds of solvents and um pesticides and things around I I don't I don't think I know truthfully I I think

01:50:10 it's very complicated to calculate such things when the when their ubiquity is so high um so so one one argument is look it's kind of baked into the Baseline prevalence of cancer today because these things are so ubiquitous asbestos in California for whatever reason it seems that there's an his bestos warning on pretty much every building if you look carefully enough except maybe the ones built in the last five years right I don't think I've ever worked in a building where the elevator was updated in terms of the inspection

01:50:44 it was always like 10 years back you always see it while you're in the elevator no one seems to worry about those or where there was not an asbestos warning or a lead warning it seems like it it's just kind of everywhere and and they're noting it in these little Flags I I don't walk around worried about I don't lose sleep over it but it it sounds like a real risk or else they wouldn't bother right clearly they're just trying to cover their it might be more cya than than anything at this point I mean I I don't know how much

01:51:09 of a risk asbestos poses when it's not being agitated in other words I don't know that the asbestos in the ceiling you know four layers up is really a problem but if they had to come in here and rip this you know ceiling apart I don't know that i' want to be in here either right it was like post 911 a lot of the workers selling that the World Trade Center um pits because that's what was left um sadly were uh developed cancers right probably from exposure to those kinds of things well I mean I would

01:51:37 argue it's also the fuels just the unbelievable amount of pollution microlution that was in the air following those things I mean that's devastating stuff so yeah those are those are fortunately the outlier events that are that are dramatic but again my my focus is basically look I could hermetically seal myself somewhere in the world maybe and maybe that would reduce my Risk by 1% or but I'm G to focus my energy on what I control because that's really hard for me to control I like focusing my things on I like focusing my

01:52:10 energy on things I can control what I can control is the uh timing and frequency of my screening that's I can't control my genes anymore um they are what they are I got whatever predisposing cancer genes I'm going to get uh I might be lucky in this regard and that I seem to get all these horrible heart disease genes and maybe not as much but you could also argue I got there are cancer bad genes in me that we don't really know about because everybody was dying of heart disease so young um but boy am I going to control the

01:52:39 screening thing what what source of genetic screening do you recommend to your patients because there are a lot of them there's 23 of me there's whole genome sequencing place you know available now in variety of formats we're this is actually one of the questions our research is working on as we speak so um we're we're trying to decide so we do genetic screening for certain things like apoe is a gene we want to know in everybody um for its role in neurod degenerative disease correct uh specifically in Alzheimer's

01:53:08 disease uh we are selectively using cancer screening in some patients but in our practice it's less important because we're generally so aggressive anyway that it turns out to to be a little bit moot we don't learn a lot in the genetic screening that's changing our screening practices because we're so thorough in our family history and we're so aggressive in everybody regardless of family history but I think there's a place for these things for example if you're looking for reimbursement on certain tests uh you

01:53:42 know I'll give an example right so colon cancer um historically was not covered by colonoscopy screening for colon cancer was not covered until you were 50 that's been bumped to 45 we still think everybody should be screened no later than 40 no I haven't had one so I suppose I should yeah I mean look I'm 50 and I've had three already so again why because colon cancer is not just the third leading cause of cancer death it's 100% preventable why because every colon cancer comes from a pop and every pop

01:54:16 can be seen on a colonoscopy so there's simply no reason to not know that and that has to be way against the cost of the colonoscopy both the financial cost and the risks which are very low but not zero um you know there's a a risk that comes from electrolyte abnormalities and hypotension from the bow prep there's a risk from the sedation and there's obviously a risk of you know bleeding or perforation that comes from the colonoscopy itself again in in a in a generally healthy person those risks are

01:54:47 so low that they're almost difficult to quantify as evidenced by a recent New England Journal of Medicine paper that was a very anti- colonoscopy paper which I won't get into because it's it's um probably a little bit of a tangent but what's interesting is despite being a very anti-colonoscopy paper this paper does a better job demonstrating the safety of colonoscopy than anything else um it just um was a oddly designed experiment so the biggest challenge with aggressive screening posture is the

01:55:20 specificity problem which is is when you stack more and more modalities around these things you're going to start finding things that aren't cancer so MRI has a very high sensitivity in English that just means if a cancer is present an MRI is very likely to see it um but it has a very low specificity which means in English it will see a bunch of things and think they are cancer when they

are not and it's most troubled by glandular tissue so glandular tissue is the Achilles heel of MRI and therefore when you use as we

01:55:58 do Whole Body MRI for cancer screening we tell our patients going in there like a 25% chance we're going to find something that is not cancer but will require us to do further investigation if you're not cool with that which is totally fine we probably shouldn't do this and again most people are okay with that but it helps to set that expectation going in that you're going to probably be chasing your tail looking at some stupid thyroid nodule that is absolutely nothing I mean I can't tell you how many useless thyroid nodules

01:56:29 we've had to get ultrasounds on that prove to be absolutely nothing and you but you have to follow them for a couple of years to make sure they're nothing what is the typical cost of a whole body MRI and so for people who are not your patients how would they go about getting those because I think most people's general practitioner is not going to script that out for them correct um I don't know the short answer because I don't know how many different places are doing it I can tell you that we use a

01:56:55 couple of different facilities and I should disclose that I'm a founder of one of them um but we use a scanner that probably um we send our patients to any anywhere they want to go but within a certain company that we like um that's not a company I have an affiliation with and I believe they're charging about \$2500 can you since you don't have an affiliation can you mention that because for instance uh you are not my physician sadly for me um and luckily for you um but I'd love to get a whole body MRI um

01:57:30 so what where can I what is this company so the the company that that makes the MRI that that we're using right now is called pruvo um it's a I I interviewed the chief technology officer and the head radiologist uh of that company on one of my podcasts um it's a super interesting Technology based out of Vancouver and for a long time that was the only scanner in the world so I had my first scan back in 2015 I went up to Vancouver to get it done uh probably had my first two up there they've now opened

01:58:08 locations all over the country so they've got they've got one in the Bay Area they've probably got one here in La um I know they have one in Dallas they so they've got them all over the place great um and then the company that I'm affiliated with with is a different typee of company that does all sorts of Diagnostics but among them is we have a pruvo scanner in that company that company's called biograph and that's in the Bay Area biograph biograph yeah spelled as one word respect yep that's very helpful in terms of

01:58:38 understanding the general risk and um ways to offset cancer to the extent that one can um and certainly what the what the consideration should be number three on the list of ways to die we should just title this ways to die or we should title this how not to die um too early neurodegenerative disease this is an area I'm I'm somewhat familiar with uh not because of my own experience thankfully but uh because of my relationship to the Neuroscience community and last time I checked I was told that everyone

01:59:16 experiences some age related cognitive decline so we all get less uh uh proficient at Focus memory um complex context dependent task switching all that stuff as we get older but it's the slope of that line that really can be controlled to some extent and that Alzheimer's dementia represents just a steep acceleration downward uh acceleration of of all of that um that was what I was told I'm guessing that that even though I reside in the not kind of but I'm reside in that community that some of that is being revised

01:59:58 especially with respect to the underlying causes of Alzheimer's because there's a lot of controversy even Scandal around this whole AP apob um ameloid plaque tangle stuff which is the stuff of textbooks for medical students and Neuroscience students what is the story with neurod degenerative disease Alzheimer's in particular how can we offset it and perhaps as importantly how can we all slow our own cognitive decline irrespective of whether or not we get what is called Alzheimer's dementia so Alzheimer's disease is both the most

02:00:38 prevalent form of dementia and the most prevalent neurodegenerative disease so it occupies that unique spot uh we're talking about roughly six million people in the United States have Alzheimer's disease that's one in uh well let's see I mean Haven checked about two% of the total population okay but that doesn't include those with mild cognitive impairment or pre-dementia or other forms of dementia and of course the right metric is not what percent of the population which of course includes children things like

02:01:14 that it's you know so that's a function of age yeah is age the major risk factor for getting Alzheimer's L we say with glaucoma a disease how much more familiar with because my worked on it for many years the biggest risk factor for getting glaucoma is AG yeah the greatest risk factor for cardiovascular disease is age the greatest risk back for cancer is age um we tend to not spend a lot of time talking about that because it's not a modifiable risk so you know we we tend to focus on modifiable risk factors

02:01:46 um so what else can we tell you just to give you kind of lay of the land so the second most prevalent neurodegenerative disease would probably be Louis body dementia followed by Parkinson's disease although the rate of growth of Parkinson's disease is the highest so I think we probably be most you know we those three diseases we want to really be paying a lot of attention to

as you know there are a lot of other neurodegenerative diseases every one of these things is devastating like multiple sclerosis multiple sclerosis uh ALS

02:02:16 huntingt disease these are awful awful diseases um there are also kinds of Dementia vascular dementia is not Alzheimer's dementia but it is it produces comparable symptoms each of these things by the way are slightly different Louis body is a dementia it's a dementing disease but it also has a movement component so it sort of sits on a spectrum that's sort of you know I mean Loosely halfway between Alzheimer's disease and Parkinson's disease um we talked obviously about age being the number one risk factor kind of

02:02:50 not that interesting because can't do anything about it so they real goal is as we age what are we doing to reduce risk um well let's start with an important Gene the gene that everybody's heard of certainly uh came up a lot on the Limitless special where Chris Hemsworth was um you know made the decision to reveal something that none of us expected when we started that whole series which was that he ended up being homozygous for the apoe for isopor so um maybe folks understand we have two copies of every Gene so for Gene X you

02:03:26 have copy that you got from your mom and copy that you got from your dad and the apoe gene is kind of a unique Gene and that it really it has three different isoforms that are all considered normal none of them are mutations so you have the E2 isopor the E3 isopor and the E4 isopor the E for isopor is the OG isopor that's the one that we have historically had as as far back as we can go we actually think the E4 isopor offered a lot of advantages back in the day it's a bit of a pro-inflammatory um isopor and it

02:04:04 certainly offered protection against infections especially parasitic infections in the CNS which would have been a really important thing to select for 200,000 years ago how do parasites get into the CNS you got a blood brain barrier you a thick skull I mean not I'm not calling I'm not telling you you have a thick skull but but I mean it just seems like parasites and other tissues would be an issue because what we're talking about here is brain disease yeah yeah anyway I take but it also could have protected them it probably offered

02:04:32 some protection outside of the brain as well um anyway the um the E3 isopor I think showed up God I think 50,000 years ago and the E2 isopor showed up very recently about 10,000 years ago now today we realize that there's a clear stratification of risk when it comes to Alzheimer's disease that tracks with those isoforms so because you have two copies you basically have six combinations of how you can combine those genes you could be 22 23 2 4 33 34 44 um the prevalence of them is basically as follows 33 is now the most

02:05:17 common three is the most common so double three is 50 5 is% of the population the next most common is the 34 which is about 25% of the population and then after that most things are kind of a rounding error so uh two threes and two fours uh would be the next most common four fours are very rare and 2 tws are the rarest of them all two tws are less than 1% 4 fours are about 1 to 2% um very important Point here is that the e E4 genes are not deterministic so they're highly associated with the risk but they're not

02:05:58 deterministic there are at least three deterministic genes in Alzheimer's disease uh one is called psn1 another one is called pn2 and another one is called AP those genes collectively make up about 1% of cases of people with Alzheimer's disease so they're fortunately very rare genes but sadly they are deterministic meaning if you have those genes you do get Alzheimer's disease and what's perhaps most devastating about those genes is how early the onset is of the disease these are people that are usually

02:06:32 getting Alzheimer's disease in their 50s um so we do have a patient in our practice actually she's spoken about this very openly um whose mom had one of these genes um and she you know got Alzheimer's disease in her early 50s was I I think she might have made it into her 60s before or she died but you know absolutely devastating consequences here why do people with Alzheimer's die because I know about the hippocampal degeneration hippocampus of course being an area of the brain important for

02:07:02 learning and memory uh but is there brain stem degeneration do they lose breathing centers or cardiovascular us usually what happens is it's sort of failure to thrive aspiration things like that yeah so it's usually they just stop eating um or they can't control secretions they aspirate they get a pneumonia or they really lose the ability to even sense like pain in their body and therefore like they'll get an ulcer and they don't realize it and it'll become cellulitic and they'll develop a horrible infection in response

02:07:32 to it I see so it's a body vulnerability the reason I asked is every once in a while a news report will come out a based on a legitimate um case study where um they'll do a scan on some person and discover that they're missing literally half their cerebral cortex like huge chunks of brain and they're functioning relatively normally and so here we're about a nerd degenerative disease of relatively it's widespread but there are a few hot spots of course in the brain that degenerate more profoundly than others and and the

02:08:00 people dying so that makes sense it it extends to lack of peripheral awareness or control and then some some acute injury or infection got it um you mentioned earlier some of the controversy right so what what are we talking about here well it it it's and I I do write about this at length in the chapter on Alzheimer's disease because I think this is a very important point right

which is the index case for Alzheimer's disease there's always an index case right you know there's the quote unquote patient

02:08:29 zero um the index case was a woman who you know a hundred years later we realized had an AP mutation I was these are AP or psn1 but she had one of these deterministic genes that led to a very early onset of disease which by the way without which we may not have come up with the diagnosis because had she just got Alzheimer's disease in her 70s it would have just been referred to as cility which is you know was not interesting enough to pay attention to um but I think it probably set the field on the path towards an overemphasis on

02:09:07 amalo beta um and it's not really clear how important amalo is which is not to say it's not important it is important and there's no ambiguity that ID is responsible for the um the changes that we see in the brain but it's not crystal clear because there are lots of autopsies that are done on people that are completely healthy and have died with no cognitive impairment and they're chalk full of amalo so what we don't fully understand is exactly what does removing amalo do um the other thing complicates the story

02:09:53 is there has been no shortage of drugs that Target amalo that have seemed unsuccessful and uh just to clarify when you say ameloid you mean people have died with their brains examined an autopsy and see that there are tons of so-called amid plaques correct um different than uh arterial plaques of course but within the brain so that the two Hallmarks of Alzheimer's um uh histopathologically would be plaques and Tangles um and even that now is of course coming under question um but for that's what we teach every

02:10:25 Neuroscience yeah graduate student it's what we teach every undergraduate it's also what we teach every medical student um and not just at Stanford but everywhere uh so I have heard that the link between AP and whether or not one develops genes for related to AP and whether or not it's cleaved at one site or another is just what you were describing and risk for Alzheimer's so it's basically a CLE it's a cleavage question right so AP people with the AP mutation I think have one extra cleavage

02:10:51 site um the they result in one extra cleavage of amalo and then it misfolds and the misfolding is what the plaque is that's being created that also then predisposes them to the neurofibrillary tangles and um again but all this is under question now right I mean this is what I was told and when I look it sounds like there were some early there were some papers early in the chain of Discovery um and the research in Alzheimer's that um were either wrong WR because they were falsified intentionally if there was an

02:11:24 intentionally falsified paper on one particular amalo uh variant and that clearly set the field back a decade because a lot of people went down that rabbit hole based on deliberately falsified data um what happened to that guy I'm gonna assume I don't know why I assume it was a guy but what happened to that guy yeah it's a good question um I think I wrote One Piece about it when it happened I actually reached out to the person who broke the story because I wanted to have them on my podcast and I

02:11:54 forget why he didn't do it I forget why he he wouldn't commit to it or something like that I thought it was a little odd because I thought this would be a great way to talk about this um I do not know what came of that scandal in other words I I haven't paid attention to it for probably nine months so I don't know you know obviously the paper's probably been recalled but I don't know what disciplinary action was taken um the field is I don't know I don't want to speak like I'm in the field because I'm not so I

02:12:25 don't I I want to be careful what I say but I I think the field is probably in in a bit of a crisis because there's there have been so many bets placed on anti- ameloid therapies and ameloid biomarkers and ameloid everything and we just haven't seen efficacy right so contrast that with cardiovascular disease where you know you have this apob biomarker you you understand the pathophysiology of how it works you have drugs that Target it so you have a biomarker so you give somebody a drug that lowers apob

02:13:04 you can measure apob that's a really important and obvious thing to be able to do and then you have clinical outcomes which is oh when you take a bunch of people in primary prevention it takes this long before you see an effect in secondary prevention it only takes this long to see an effect right different risk stratifications all these different things we don't have any of that for Alzheimer's disease so we do use there are now serum amid biomarkers that we use and we do track these in our highest risk patients but only because

02:13:33 we believe and I don't know if we're right by the way that lower is better and therefore if we make these changes to you and your serum ameloid levels come down that that tells us something about what's happening in your brain that's favorable but I mean I would hate to represent that we are practicing nearly the level of precision medicine there that we are in cardiovascular medicine when it comes to Alzheimer's disease maybe take a step back when it comes to brain health I think there are a handful of things that seem

02:14:07 unequivocally true and there's a lot of stuff that is signal to noise ratio that's really low so the unequivocally true things for brain health are sleep matters another unequivocally true thing for brain health is that lower LDL cholesterol and apob is better than higher another thing that is unequivocally true is not having type 2 diabetes matters so having really being yeah being insulin

sensitive insulin sensitive matters sleeping adequately matters having lower lipids matters those three things

02:14:52 are clear and the fourth one that is unequivocally clear is exercise matters more specific form of exercise uh very I mean so I tried to answer this question on a recent AMA that I did because the answer is more is always better but if you if I tried to have one of our analysts look at it through the lens of if you could only exercise three hours a week what would be the highest use case and our interpretation of the literature was if you could only spend 3 hours a week exercising you'd be best off doing

02:15:26 one hour of low intensity cardio one hour of strength and one hour of interval training so if someone said like I only want the minimum effective dose you're going to get a pretty good bang for your buck doing that but I would argue if your brain really matters to you do more one hour of interval training is no joke no because you're going to spread that out over probably at least two workouts yeah um but Andrew those four things are basically the only thing where there's there's no ambiguity about

02:15:54 the benefit what about head hits like don't get don't hit your head uh seems almost assuredly true in a susceptible individual for sure um so I put that yeah maybe we could include that as well well I just men you know one of the things I've been learning recently is I know you boxed um uh for a number of years when you were younger I boxed a little bit hit my head a number of times skateboarding but you know we think about sport injuries as the major cause of head injuries but then I've got colleagues car accidents bike bike

02:16:25 accidents I've got so many colleagues and children of colleagues growing up in around campus that were hit by cars on Woodside Road or you know I mean there small object surrounded by you know three what a car weigh 3,000 pounds or something like that um you know it's unbelievable the number of head injuries and then construction sites because those ridiculous little hard hats which um don't protect against anything except um I don't know maybe uh uh windblown hair that they they basically predispose

02:16:55 the whole situation predisposed people to head injuries very common on construction sites and then um say nothing of military Etc so I think that um I was told that the the best thing to do if you get a head injury um is to not get another one in other words if you can stop doing the activity that leads to more head injury yeah the other thing that I think is emerging and I hope it is studied rigorously is the use of hyperbaric oxygen immediately following uh a TBI a traumatic Maran injury I reached out to um Dom Deus youo a little

02:17:27 while ago to kind of because he knows a lot about this lit um to say hey is there anything out there that's really kind of TurnKey convincing and he said not yet um they're still doing it right so I would do this like if I if I was in a car accident tomorrow and sustained a concussion and by the way I'm not a proponent of hyperbaric oxygen so I you know we have an internal white paper that we wrote inside quite recently where where I examined when I say I examined you know the analyst team examined and I pushed back and reviewed

02:17:58 um and I I came away very kind of bearish on hyperbaric oxygen I don't think I don't think it's harmful but I think all of the claims are nonsense you know tiir extension is totally irrelevant if you actually look at the studies they're the worst done studies I've ever seen in my life I'm sure you've seen some of these where it's like you put these people in a hyperbaric chamber and then watch them do cognitive tasks after and they're so much better well the fine is they don't even have Placebo groups here like can

02:18:24 you imagine doing a study without a placebo group or your placebo group doesn't go into a sham chamber yeah I mean one of the big problems of the proliferation of all these pay-to-play journals meaning journals that will basically publish a paper with minimal or poor peer review um because they charge in order to publish um and then offer free access you know free access sounds great but when it's pay to-play typee journals there's been a huge proliferation of papers most of which you find on Twitter um in which the

02:18:52 study design is is beyond that like like a ninth grader who woke up late for school and was parying all weekend could design a better study than most of these studies and there's some excellent studies out there as well of course presumably and eventually on hyperbaric chamber too so I'm not picking on hyper baric chamber per se but the the proliferation of of truly terrible science that's published in peer-reviewed journals is is just overwhelming yeah it's insane and all of that is to say I think there are places

02:19:23 where hyperbaric oxygen makes sense clearly in wound healing it does it's it's a miracle treatment for wound healing and I would absolutely use hyperbaric oxygen if I suffered a concussion um but you know beyond that I think it's pretty pretty tough to make the case where do people go for that I mean there clinics yeah there clinics you basically go to protocols have to be very precise I mean you're this isn't something to Cowboy at home you know no I no no you have to go into a real chamber um I think the TBI protocol

02:19:54 that's most commonly used is God I want to say it's pretty intense it's like five 60 Minute sessions a week at two atmospheres oh boy like it's not it's no joke um so from a cost and time perspective it's enormous and and the time and cost are reasons why I think when I see people doing hyperbaric oxygen just because they think it's going to help them live longer I'm like dude you

know what you could do with 5 hours week plus the commuting time that you put into that like it's put that into exercise and I promise you you'll

02:20:28 get a bigger benefit than you're getting out of hyperbaric oxygen um but there's a lot of other stuff that I just think is maybe helpful there's tons of supplements that I think about when it comes to brain health you know what about thumin what about magnesium with L3 and8 the transporter um what about methylated vitamins that lower homocysteine what about EPA and DHA and we've gone through all of the literature on that stuff and many of these things we still are recommending through a kind of basically like the

02:20:59 potential benefits outweigh the potential costs but the evidence is really unimpressive for most of those other interventions so when you think about the big four or big five if you include not getting head injury everything else is probably a rounding error compared to those big ones maybe just for sake of of um thorness we could just list off those four again exercise exercise sleep insulin sensitivity um and lipid management well along the lines of head injuries we should probably move to the

02:21:30 next category of um uh how not to die is to avoid accidental death uh how common is accidental death and what are these accidental deaths because we are separating this out from Automotive death so is this people um falling while hiking self self's gone bad um you know what are we talking about here I'm not chuckling because I like it's just I mean it seems like there's a near infinite uh ways ways to um to die accidentally uh and one use I think there's two ways to kind of look at this um I and and so here I kind of merge two

02:22:07 categories um so I would call it that're they're that overlap in the way that they're characterized by the CDC but I would sort of we'll we'll we'll we'll talk about them separately and bring them together so if you talk about true accidental deaths Automotive uh and falls and overdoses are the are the three that's basically what it comes down to so you know in our death bar analysis we kind of list all this stuff out in fact I think that's actually one of the figures in the book is I have the accidental death uh figure that we've

02:22:40 put together where we've adjusted by population and you'll see a couple of things if you look at it in absolute terms it's basically a pretty con so regardless of what decade of life you're in once you're above you know 20 accidental deaths are pretty sizable number of of deaths now car accidents seem to be pretty constant throughout life little more common if you're under 60 than over 60 but they never go away I was told that um in teenage and boys and and uh boys in their in their early 20s alcohol induced F uh Automotive

02:23:19 fatalities place them at at this an astronomic risk is that just not true it's not true anymore compared to overdoses is that because young people now um aren't getting their driver's licenses I've also heard that yeah well I think it's also because we're seeing such an uptick in the deaths that come from fentanyl got it so fentanyl related deaths have basically squashed all other deaths below 65 on The Accidental front really oh it it's not even close because of the number of different substances that fentol is being woven

02:23:51 winding its way into everything right so all counterfeit drugs all illicit drugs and look most of the time you're not getting a lethal dose so it's you know it's it's but but you're getting lethal doses so often now that um well you know I did a little analysis actually the other day when I looked at how are deaths of Despair increasing over the last 5 years so what did I Define as a death of Despair suicide alcohol related death or overdose accidental overdose so that we differentiate that from suicide where suicide is obviously

02:24:27 deliberate and accidental is not so if you just looked at those three things so accidental overdoses suicides and alcohol use or alcohol rated death um not including driving by the way this is like therosis of the liver that comes from that number is going up at almost 20% per year since 2019 so the I couldn't get 2022 numbers yet so at the time of the time I did this analysis which was last week um the 2021 numbers was about 210,000 Americans goodness up [Music] from 80,000 in 2020 up from like 150,000

02:25:16 2019 so is this um and that is driven almost almost entirely by fentel use so I'm trying to um get a sense of how this would happen while back there was an article in the New York Times that some photographs of people that um uh died of fentanyl overdose they and said they they went out to buy cocaine and died and I thought to myself this is a really kind of odd socio uh biological phenomenon right because I mean here there're they're not demonizing these cocaine user I mean they went out to buy

02:25:47 cocaine right this is not a um I know cocaine has one narrow clinical use as a prescription drug but in general when people buy cocaine they're they're quote unquote partying with it or using it to work longer hours or something like that um so the whole nature of the article was a bit strange to me but it clearly pointed the fact that people are using cocaine okay that's no surprise but people are going out and buying cocaine they're presumably buying Valium they're presumably buying this is where it's really killing kids but this

02:26:17 is online this is in person I mean the reason I'm so so ba by this is let let me uh contextualize what I what I've said so far about this question I was surprised that the times would write a paper about the tragedy of cocaine users dying of Fentanyl and I think they did it to highlight this fentanyl problem um because people have been using cocaine for a long time and typically

those are not the members of the population that we really focus on since the mid 80s the so-called cocaine and crack epidemic so

02:26:50 basically tells me that people like you said illicit drugs so cocaine but also you know what other sorts of drugs are where the majority of people are dying from fentanyl poisoning and I had a guy on my podcast recently named Anthony hippolito and if anybody's interested in this topic they really need to go listen to that so I watch the YouTube version of this and your podcast are are excellent so people if you're interested in this and I think everyone should be interested in this if you have a child

02:27:17 or know somebody who has a child you just got to get this podcast into their hands because it's the most important Public Service Announcement I'll probably ever do in terms of saving more lives potentially um where the majority of this is making its way into the into The Accidental poisonings is through illicit counterfeit pills so it's when kids are out there buying you know oxy they want oxy well they can't they can't get real oxy right because they're not going to go to a doctor and get real oxy

02:27:46 so they're going to buy it through you know Snapchat right they're going to buy it through some drug dealer that finding on social media um they're buying sleeping pills they're buying all sorts of counterfeit stuff like Aderall any of these things are being laced with fentanyl adal absolutely wow I I assume the fent and again the reasons are it's insanely cheap to use synthetic Fentanyl and secondly and again but the effects of fentanyl are nothing like the effects of arerol so cocaine um doesn't make sense

02:28:16 for that reason cocaine doesn't make sense either yep and yet it's still showing up in cocaine again I I don't think that's the dominant place it's showing up I would I would guess that the dominant place it's showing up is in counterfeit opioids so any opioid barbituate any sedative depress but let me tell you what I'm telling my daughter right because this is to me it's a Frontline problem I have a 14-year-old daughter I'm like listen I don't care which friend of yours it is I don't care how much she's amazing if she tells you

02:28:45 to try this sleeping pill because she took it the night before and it was really helpful or this will help you study better or this will help you do anything I'm like just come to us we got a better pill for you right like in other words I you can't trust anything because you don't know where she got it she has the best of intentions I'm sure when she's given it to you and by the way she probably took it the night before and was just fine but the people who are making these pills are not exactly up to GMP standards so there you

02:29:12 know you just have no idea which pill is getting what dose of fentanyl one thing that Anthony hippolito told me that I simply couldn't believe I had to ask them six times was that some of these pills have like 1 mgram of fentanyl in them now I made the point on the podcast that a 100 milligrams of fentanyl for most people is a hit like they've like I've had fentanyl before I've been in the hospital and you know I've had fentanyl 100 milligrams is like wow that is such a trip why are people dying from

02:29:45 one milligram intake respiratory inhibition you can't breathe that shuts the brain stem off well I don't think we can highlight this enough um you know adults are dying kids are dying I met someone just earlier this week who told me her 35-year-old son died of a accidental fental overdose and um and he wasn't at least by her description a drug addict or anything of that sort I think yeah this is this is we're talking about a different game now right so it's like these are kids that have anxiety

02:30:09 these are kids that are you know are are are sort of addressing another issue with these with these pills and that's why I think this this whole concept of deaths of Despair is is is a really important one but back to your question what do what do accidental deaths primarily amount to for for the Aging population again it is so clear that it is fall related this is where um once you hit 60 65 the the risk of a fall that results either immediately in death you know you hit your head and die going back to like

02:30:46 cerebral hemorrhage or it is the straw that basically leads you down the path to death within the next 12 months is astonishingly high it's so high that it's sort of hard to wrap your head around but if you're over 65 and you fall and break your femur or hip so you either crack the femoral neck or the femur itself your 12month mortality the probability you will be dead in 12 months after that break if you're 65 or older depending on the study is about 15 to 30% wow wow so in terms of offsetting the

02:31:24 probability of Falls um You' talked a little bit about this um before but I uh you and I have talked a little bit about this before but maybe we could go a little bit deeper um people's ability to jump and land seems to be highly correlated with one's ability to not fall or at least fall and control the fall in a way that leads to no or less severe injury yes so Andy Galpin talked about this on your podcast he talked about it on my podcast what is the Hallmark of aging on the muscle it is atrophy of the type two

02:32:01 muscle fiber that's the Hallmark fast twitch fast twitch muscle fiber so if you want to understand what looks different in 50-year-old Peter versus 18-year-old Peter it's not my type one fibers it's my type two fibers it's my fast twitch fibers it's my explosive fibers I mean when I was 18 years old I could vertical jump over 30 in to today I'm lucky if I can vertical jump 24 in and you know

and when I'm 60 boy it's like my goal is to be able to vertical jump 60 uh 20 inches when I'm 60 and I don't know if I'm going to be able to do

02:32:32 it I've seen some videos of some uh 80-year-old sprinters that are pretty impressive and certainly 80-year-old gymnasts yeah that are impressive I've not seen very many videos of 80-year-olds um dunking basketballs for instance yeah who are not more who are not uh taller than six feet um so so when we lose you know our so so again if you just think about size strength speed we lose speed first we lose speed then strength and the last thing you lose is size so again size is agnostic to fiber right you you could have big type one

02:33:12 fibers and still have lots of size they're not going to be that strong and they're certainly not going to be fast so what I mean like we could go through we could spend hours on this particular topic but I think the most important thing that people need to understand is you cannot age well if you are not doing the type of training that is there to strengthen and delay or minimize the hypertrophy of your type two fibers so everything matters right you have to be doing your Zone 2 you have to be doing you know all of these

02:33:41 other things but some component of your training needs to be stressing the type two fibers you have to be doing strength training that those fibers you have to be doing reactivity training you have to be doing explosive training and ideally some training that involves jumping and Landing well jumping is a very big part of it and Landing is a very big part of another one of what I kind of think of as my four pillars of strength training so one of the pillars of strength training is Eccentric strength which is

02:34:11 breaks so um you know you're going to hurt yourself 10 times more likely I'm making that number up by the way I don't know if it's 10 times but experientially it seems to be you are 10 times more likely to hurt yourself stepping off something than stepping onto something right stepping down versus stepping up um because when you step up onto something you are concentrically controlling a muscle when you step down you have to apply the brakes and that's where most people falter much harder to walk downhill than uphill uphill is

02:34:47 taxing your cardiovascular system but if you slow down enough you're fine but a lot of people don't have the ability to slow themselves down when they're walking downhill and so when an older person steps off a curb and can't fully stop themselves and that results in a fall so you know I like doing things like a broad jump broad jump is a fun little test set I like to do every once in a while I always want to make sure I can broad jump six feet that's kind of my arbitrary number that I've chosen and

02:35:14 the reason is on the takeoff that's a very explosive movement but the landing is just as important if I can't stick that Landing it means I don't have the braks so those are kind of some of the tests I want to be able to do to make sure that I'm utilizing that system because I do think you know look I've watched my mom fell gosh probably been about four months ago just fell in a typical way that people fall um by the way it could have happened to anybody it's not like

02:35:42 you know my mom walks around and moves around just fine but in this particular day she just tripped on a uneven Stone and fell and landed and broke her hand and she really lucky she didn't break her hip and I told her that because my mom was you know probably in her mid-70s and I said look you know if that was your femur I'd give you a 30% chance of dying in the next year I mean it's just an un those are such difficult to recover from injuries because first of all you're dealing with the

02:36:12 immobility of you know the hospitalization and immobility that follows that and the amount of muscle loss that occurs uh could easily be you know four or five pounds of lean tissue lost that for most people that age becomes almost impossible to get back that says nothing about sort of the acute causes of death like a fat embolism that results from a broken femur a blood clot from laying in bed those things are also catastrophic but what happens is a lot of these patients just never get back to the same

02:36:41 level of mobility and you know now I think in many ways we're kind of pivoting from what kills you to what ruins your quality of life and we spent so much time talking about what kills you but I think you might as well be dead in some ways if you can't do the things you want to do and if playing with your grandkids or gardening or playing golf or going for a walk with your spouse or think of any of the things that we all do today and take for granted if you can't do those things I don't know you sort of

02:37:13 lose the the reason to be around and often times um the inability to do those things is associated with pain MH that you know which is uh psychologically and obviously physiologically so so distressing um you mentioned the four pillars of Health maybe just list those off for people the well the four pillars of um longevity through physical uh yeah yeah sort of the exercise pieces of them yes yeah so strength stability aerobic efficiency and um aerobic Peak output guess aerobic Peak would be

02:37:50 Zone that's in my analogy that's the your your zone two is the is how wide the base of your pyramid is and your V2 Max is how tall the peak of the pyramid is so the best Pyramid has a wide base and a high peak so you could have a reasonably wide base and a shallow Peak if you just did zone two training you know you're going to get a reasonable Peak but it's not going to be

that high you have to do some of that specific training if you just focus on high intensity you might drive up that V2 Max but you're actually going to have

02:38:19 a Rel wide narrow aerobic base so think about just maximizing the area of that triangle widest tallest stability and strength stability of course encompasses everything we're talking about in terms of reactivity um you know I I I dedicate a chapter in the book to this concept because it is so foreign to most people um and and for understandable reasons it's just it's not sexy it's not it's the hardest one to train it's the hardest one to understand but it's so so important because it's the thing that I

02:38:51 think differentiates people who age well and and people who don't age well and I should um perhaps throw in there please correct me if I'm wrong but also most of the machines that are in typical commercial gyms that allow people who are not um very experience to start doing some resistance training don't really tap into the stability Factor terribly much so while there's value to leg extensions and leg curls and you know chest presses and shoulder presses done with machines certainly uh for a number of reasons and can often be safer

02:39:20 than freeways especially for people who are approaching at a later time or are new to the whole thing they don't really lend themselves to um real life stability walking down as you mentioned walking downstairs uh with in the absence of a handrail or um or movements in um uh kind of uh odd planes you know having to step aside to avoid a bicycle right um at an angle as opposed to just moving you know linearly um yeah and by the way a lot of things that don't machines still don't give you that right

02:39:52 like I mean doing a deadlift you have to be stable to lift a heavy weight like you would a deadlift without hurting yourself that requires an unbelievable capacity to harness intraabdominal pressure and to be connected you know espec if you're giving a lift 500 pounds off the ground you're stable but that still doesn't prepare you for what you just described so stability is multifaceted and it involves doing a lot of things you know today for example I finished my today was a a cardio Zone 2 day so I did my cardio Zone 2 and I you

02:40:23 know had it extra 10 minutes before I needed to kind of get moving and so all I did was step ups for 10 minutes I just did single leg very slow step up and insanely slow step Downs off a box in a gym so 2 second up 4 second Down 2 second up 4 second down with you know and I would do them with ipsilateral loads contralateral loads all sorts of different things and you know basically that's just a stability game for me it's like I'm building that concentric strength in um in a movement where it's

02:40:57 easy to cheat um but can I do it without cheating it's terrific and it's terrific that you covered all of that in the book in addition to these other topics so several times during our conversation today you alluded to quality of life and one of my favorite segments in your book indeed the segment in your book that I believe could be it's own entire book of tremendous value is the section on emotional health if you could just share with us a bit of what inspired you to include that section was this uh for

02:41:33 instance um based on communication with your patience to what extent it was based on your own life experience and then um maybe we can drill a little bit deeper into what's contained in those chapters and what really constitutes emotional health well I mean I think that that chapter of the book which is a pretty long chapter It's the final chapter as well um is certainly different from all of the others in that there is no uh there's no confusion about expertise right I think in the other chapters I at least try to come across

02:42:09 as having some knowledge on the subject matter and uh I'm writing them most often as you know quote unquote the doctor right whereas I think that last chapter is is much more about an experiential side of uh my knowledge acquisition and and therefore really it comes across more as a patient um and I think you're right I think that that's a chapter that initially was resisted by all other parties involved in the book so my co-author um my editor everybody else sort of felt like this is interesting

02:42:46 but it's a it's a separate topic if you want to write about this you should write another book about it but it doesn't really belong in this book um I disagreed for two reasons and ultimately I guess my opinion prevailed uh the first is I didn't want to write another book so it just that you know not including this in this book to then write about in another book was not something I was interested in doing but I think more importantly I do think that this book is about much more than how long you live and while we have talked

02:43:20 about and will talk about uh in the book that is you know how cognitive and physical health are just as gerine to quality of life as they are to length of life this other piece of emotional health you know it's potentially the most important of them all it's also the hardest to Define but without it none of this other stuff matters right so there's you know infinite lifespan if if if you're miserable means nothing might even be worse it's that would be a curse right you could argue how could

02:43:51 you punish somebody the most allow them to live forever and be miserable is there a um there's a Greek god tonus yeah tonus yeah he was granted immortality uh it's a bit different he was granted immortality but without a health span basically so he aged forever Dreadful yeah and this would be Dreadful too right and and I feel like why did I need to write about this well I think that

you know this is probably my greatest struggle I think um you know way at the outside of the podcast you asked me kind of like what are the

02:44:26 obstacles to longevity and that got us down a path of some very um black and white things but when I look at a patient I create a dashboard and the dashboard is what are all the things that are a threat to every component of your longevity both lifespan and health span we talked about a bunch of those things so how what is what is your risk for atherosclerosis and what are we doing about it what is your risk for cancer what are we doing about it what is your risk for neurodegeneration what are we doing about it what is your

02:45:00 risk for accidental death what are we doing about it what is your risk for physical decline what are we doing about it and one of those things is what is your risk of emotional health or poor emotional health and what are we doing about it um so when I do that exercise for me which I've I do right I mean I I can I have that spreadsheet laid out for me and I know where my factors line up and interestingly despite my family history being horrible for atherosclerosis it's like sixth on my list because I mean basically I

02:45:36 intervened early I have a clear understanding of the pathophysiology and I'm doing everything to the maximum so I'm actually very confident I will die with and not from atherosclerosis but the top thing on my list is actually emotional health that's the one that is the hardest for me to manage and it's e it's the easiest to get out of balance and it creates the most pain in my life so that's that's a long answer to why I felt this needed to be in here well in the book you go into um very honest detail about some of your

02:46:16 Journeys through and challenges with uh emotional health and paths to overcoming those maybe we'll get into those a bit but before we do uh how should we Define emotional health um this to me seems like one of the most difficult areas to calibrate oneself um like even just measuring emotion is tricky uh language is the dissection tool for um psychologist psychiatrist and indeed for all of us you know how are you doing today great or I'm miserable or I'm depressed I mean it means such different things to different people obviously

02:46:51 suicide being the far end of of um we presume misery there are instances of manic suicide but you know um depressive misery but uh setting that aside I mean how should we evaluate think about and communicate emotional health to ourselves and to the relevant people that could potentially help us yeah well you're right it's it's it's it's it's it's it's very difficult right and and so much of what goes into this book is about things that are much easier to quantify uh it's very you know I could sit here and talk for

02:47:29 days about all the ways we quantify from the histologic to the gross of each of these diseases you know genetically all of these other things um with emotional health it's it's far more vague and I don't even attempt to come up with a definition right I can tell you things that make up components of it so connectivity with others just seems to be an inescapable part of this so the ability to maintain healthy relationships and attachments to other people having and by the way these are in no particular order having a sense of

02:48:06 purpose uh being able to regulate your emotions experiencing fulfillment experiencing satisfaction um all of the things matter and I think that for many of us if we're taking an honest appraisal of ourselves we'll notice that we have deficits in these areas um being present by the way that's something that may have been less of an issue hundred years ago than it is today so I think you know for certainly for me being present is very difficult it's not my default state I don't know that it's the default state

02:48:51 for most people truthfully um but I'm very often predisposed with thoughts about the future occasionally thoughts about the past but it's much more often kind of thoughts about the future and planning and thinking about what I need to do and what do I want to do next and never really being satisfied with anything that's happening the moment um so I have to work hard to kind of overcome those things and I'm sure you can appreciate this but when you are present you generally are in a much better frame of mind yeah

02:49:21 there's an interesting study I think it was initially published by Dan Gilbert's lab one of these long-term hap happiness studies uh that was published in Science magazine um uh that pinged people for their level of Happiness unhappiness presence or lack of presence multiple times throughout the day this was in the early years of smartphone so this is around 2010 2011 so the technology wasn't as good as is now but it was good enough to do this in a very large number of people I forget how many but

02:49:50 certainly more than 10,000 and pro that number is I'm stating it intentionally low and what they found was regardless of whether or not people were doing something they enjoyed or not boring to them or not the degree of presence to what they were doing was a stronger predictor of their happiness in that moment and overall than was anything else um and also a pretty fairly rare feature for most people so seems like it's something that we do need to work at perhaps nowadays as you point out more than um we perhaps had to in our

02:50:24 ancestral past I'm a little bit surprised that um uh you say that you find it hard to be present because you strike me as somebody that um is not just willing but has a a strong um almost reflex toward you know Drilling in you know observing the the Contour of something and then really drilling into it and and really getting to the the guts of of most everything that that interests you so

you strike me as somebody who's very present and I guess maybe this gets back to this but they're not exclusive right

02:50:55 I mean I think so for example I'll notice that sometimes if I'm playing with my kids especially my boys because they're younger right and and playing with them is really being in their world like if I'm with my daughter we can be doing things that are kind of mutually like you know we'll do things together that I would probably do by myself or she would do by herself but with my boys it's generally doing something I wouldn't otherwise be doing and I'm if I'm paying attention to it I'm constantly amazed at how after five

02:51:29 minutes of searching through a bin for just the right Lego piece that we want to do to build this one little thing like my mind will start thinking about something else like oh my God like I got to go I didn't email that dude back and I got to do this and I got to do this and I got to do this and I gotta do this and I just get into I got to do I got to do I got to do and it's like dude you've only been here for five minutes why don't you just find the Lego piece that you need to finish building that thing

02:51:58 over there that is this beautiful moment that you're not going to have many of right there's a very finite number of these moments you're going to have um so you want to save for every one of them so again I don't think I'm alone in that I think a lot of parents for example can relate to that and that that's that that's literally just one of many different things and by the way wouldn't have said that that was my greatest challenge either but it's something that requires I think deliberate attention what you're alluding to is a a

02:52:29 challenge with um holding a single um time perception or perception of time uh one of the most remarkable things to me about the the human brain is our ability to be present or think about the past or the future or the present in the future and we can occupy different time BS and in a recent um unrecorded conversation of our hours uh you showed me something that uh I've seen before but for some reason this time it had a profound impact on me which is that you have a chart of the number of weeks that you're

02:53:01 going to live and you mark them off one week at a time we were talking about this in the context of uh major life decisions um and it illustrates the fact that we need a a chart such a chart that we can't really move through our day being present to the the beauty of working on Lego with our kid while also paying attention to the fact that wow this is week number whatever you know 600 in the or you know X number of weeks of one's life so that that um ability to uh contract and dilate our time perception is is marvelous but it's also

02:53:39 um a double-edged sword because it's it's what takes us out of what's meaningful in the Moment One sort of has to wonder then whether or not our our um challenges in being present um you know I guess the the psychoanalyst maybe we need to or psychiatrist maybe we need to ask our Paul Ki uh um who you know and I know um and respect greatly um whether or not this is some um you know subconscious uh refusal of of our own mortality or something right that if we were to really contemplate our mortality on a

02:54:11 regular basis not just when we're marking off the weeks of the poster we wouldn't be able to be present because it's kind of overwhelming right I don't know I mean doesn't I I feel like the literature says that people who spend more time contemplating their own mortality are actually more at peace uh kind of a little bit of the exposure therapy idea um and so so I'm not sure it's an unhealthy thing to be aware of your mortality I suspect it's it's helpful in as much as you accept it right and you and you feel like you have

02:54:45 some agency over parts of it right like I I don't think I have nearly enough agency over the length of my life I think I've got five to 10 years of wiggle room that I can extract if I do if I do all of the things that I've written about in that book I I bet I can stretch my life out 10 to 15 years at the maximum call it 10 over what would have happened if I didn't do those things maybe it's more but but you know that it depends on what we're comparing it to right from being reasonable to maybe being a little bit you know

02:55:19 hyperfunctioning maybe it's 10 years but where I know I have a much greater agency is on is on quality and for me now a big part of that is in terms of quality of relationships I think that's a big thing and I I think for most people that's that's what I hope this chapter does is it it is it sort of allows more people to kind of take an appraisal of that and ask that question which is before too late am I living my life more for my resume virtues or for my eulogy virtues to borrow from uh David Brooks's work the

02:56:01 road to character which I I talk about as being kind of one of the many aha moments that I had during this journey yeah and there again thank you you recommended the road to character to me I do an annual solo uh Wilderness trip and I listen to it during the drive to that trip and on that trip and it's a um it's a I would just say it's it's a truly important book for everyone to listen to it's really quite um quite impressive what are the things that you do on a regular B let's say on a daily

02:56:33 basis to try and enforce um forgive the word but enforce emotional well-being and health in terms of relationships because as you pointed out it's not reflexive for for everybody and that doesn't make them bad people it I think it does have to do with this um challenge in balancing expectations of work and other things and and for some people a more inherent selfishness and for

some people um they aren't selfish enough right I know plenty of people that are running around trying to serve everybody and then their

02:57:02 health is crashing or their mental health is crashing so it can cut any which way or always ways what what sorts of practices do you incorporate or just even thoughts within your own mind do you use charts and lists I mean you're very regimented about your workouts um building grip strength uh Eccentric um zone two e Centric training Zone 2 Etc why wouldn't we also um script out the things to pay attention to each morning and day as a list of to-dos well it it I have done those things right so so certainly you know and I write about

02:57:33 in the book I've gone away a couple of times right so I in 2017 I spent two weeks at a facility in Kentucky in 2020 I spent three weeks at a facility in Arizona um and on the back end of that facility 3 years ago when I got out I mean I had uh I had a very clear list of daily things I needed to do and so so at that point for about six months following getting out of that stint of rehab I mean I was I mean God the list of behaviors I was doing every single day I mean twice a day standing in front of the mirror

02:58:10 reading my list of affirmations writing in my journal every single day I had therapy every single day I mean all of that stuff was highly regimented you know today I would say there's no one single behavior that is quote unquote mandated as part of my recovery but perhaps the most important thing that does come up every day is um being mindful of and acting on as quickly as possible every time I uh do something damaging to a relationship so um I would say that like if you compare Formula 1 one of my

02:58:54 my favorite sport by far if you compare Formula 1 40 years ago to Formula 1 today the difference is not in the number of accidents that takes place the difference is in the fatality of those accidents there are just as many if not more accidents in Formula 1 today the difference is nobody dies in those accidents the cars are so much safer they're engineered first for safety second for performance it used to be the reverse and that's why there was a day when every second or third weekend a driver was

02:59:32 killed it's catastrophic to imagine what took place between the mid-60s and about the mid 80s in Formula 1 and similarly I would say that the frequency with which I have an interaction with a person who matters to me that is not the best interaction it could be is only slightly less than what it was five years ago the difference is the severity of that is much lower and more importantly and most importantly the length of time between when I screw up and when I make amends is infinitely shorter right it went from being I would never

03:00:17 make amends to if I'm a dick to my wife I usually am trying to rectify it within a few minutes or at most a couple of hours and that and so it's it's really you know one thing I learned throughout this journey was if if you hold yourself up to this goal of I have to be perfect I have to be the perfect dad I have to be the perfect husband I have to be the perfect friend you're going to set yourself up for failure because you know you're just not going to be perfect but if instead you can say what I'm going to be perfect

03:00:51 about is repairing damage when I cause it that's what matters you know the other day um I yelled at my son for something it was a while ago actually before I lost my voice so you know I don't know he was just doing something and he was wrong you know like it was like he he did something I told him 150 times not to do and I yelled at him and punished him like you know but I was way too harsh like cuz basically I basically the first 27 times he did it I didn't respond and then when I finally did it's like I blew

03:01:26 a gasket right but what I realized is yeah I you could say well maybe it hurts a child to do that but I think it hurts them way less if you can immediately go and repair and say hey buddy daddy was a little harsh in that I'm sorry I didn't mean to yell at you like that but what you did is wrong and you're not going to get to go out and play right now as a result of it but I love you very much and I want us to do better I want it I want you to do better in not doing this thing and I want to do better and not yelling at you when you

03:01:57 do this thing so it's not this not rocket science right but I just think I used to live my life in a way where all I did was break and never fix it so you're living in a house where everything is broken whereas now I still break things but now I clean up the mess and oh like all of a sudden the house is better what is your process for when there's a need for repair but um you feel that it wasn't you it was somebody else's um error or potential error so you um very humbly uh Express how you go about

03:02:38 repairing um your your errors um but what about situations where um a loved one a cooworker you feel screwed up or wronged you right as many people do we all do from time to time feel this way um do you approach them uh and try and repair the the situation um because there's a little bit less or far less control when um you know then the situation you described and by the way the situation you described I think is a perfect one because um I think uh we all screw up and so the answer to this second question is sort of the answer to

03:03:15 the first which is if everyone did what you were doing the world will be truly a far better place but not everyone's doing what you're doing so if some if you feel wronged um assuming that wrong was it you know wasn't sociopathically motivated what is your process for going about repairing a relationship fracture like that again this assumes that this is a relationship that matters

right so in every interaction you're you're only really able to optimize around one thing and you have to decide is this one thing

03:03:46 that I'm optimizing around the relationship or is it the outcome there are other things to optimize around but you understand that those are different right and maybe you could elaborate on that a little bit I think I get it but I but flush out a bit if I'm at the uh if I'm at the market and I'm trying if I'm at if I'm trying to buy a new car and I'm sitting there talking to the car salesman uh that's a relationship that's an interaction now I want to buy this car for as little as possible and he wants

03:04:12 to sell the car for as much as possible well in that interaction my relationship with him means nothing let's assume I don't know this guy and he's not like my best friend I'm optimizing everything around the outcome so everything I do in negotiating and in interacting with him personally is based on getting the best outcome for me it's very selfish right nothing wrong with that by the way he's doing the same exactly but now for example pretend that you are the car salesman and you're one of my closest

03:04:44 friends and it's your dealership like it's your money like it's you know you can't sell this thing to me at a loss I don't want you to do that because I I want you to be able to make money and similarly like you care about me and you don't want me to overpay for this so now we're negotiating and we're both trying to optimize for an outcome but the our relationship also matters it's a very different negotiation at that point and so I think I always try to ask myself this question when I'm having some

03:05:14 interpersonal conflict which is what am I optimizing for so you know if if I'm having a quarrel with my wife I have to remind myself that the outcome is the objective or outcome is not necessarily the top priority you know being right all the time which is my default State it's just to be a bull in a china shop it's to be authoritarian instead of authoritative and that's that doesn't work if the relationship matters so to answer your question the first thing I'm going to ask myself if I'm trying if I

03:05:55 feel slighted is what is the nature of the relationship is it even worth trying to do something about this and presumably you're asking the question because the lens is yes this is someone who you you care about more than in just a transactional way you know usually what I've realized is I can't try to approach the situation without fully understanding myself and that takes a while so generally and this is where you know I still one to two times a week I'm still working with a therapist I have to

03:06:30 kind of try to figure it out on my own and then usually bounce it off a therapist and say well I think this is why I'm upset about this I I think that when this person did this or said this I felt this first of all am I am I correct in what I felt because remember sometimes you might at least for me this was the case I would just feel anger in response to every interaction but what I didn't realize was that anger was really just another emotion that was superimposed on top of hurt or superimposed on top of fear or

03:07:06 superimposed on top of shame or superimposed on top of something else but I didn't know how to articulate any of those other emotions so the only thing I could really articulate was anger so if anger is the only thing I know and anger is the only response I see it's not very helpful it's not very insightful so that's that's a big part of it is being able to deconstruct what I'm feeling oh what I really feel is loss or what I really feel is abandonment right now and that sometimes takes a while to figure out at least for

03:07:39 me like I I'm still you know I'm only a few years into this journey and maybe other people figured these things out when were in their 20s and so they're veterans they can do this more naturally but that's step one I if I don't really understand what's going on I can't even begin to try to approach this person to say this is how I feel um this is you know how do you feel and and what are we optimizing for in this interaction well I certainly know you are not alone in this this sense that

03:08:15 it's a process and it takes a lot of time and um and on a case-by Case basis can take a lot of time to figure out you know exactly what one is feeling I think it really um goes back to the the coess of language as a way to sort one's feelings it was actually your other because we mentioned Paul Conti who was one of your um Stanford Medical School um uh classmates but another previous guest on this podcast who was also one of your medical school classmates um do Dr Carl daero right psychiatrist and

03:08:45 bioengineer of of phenomenal um stature and doing amazing things in the world who said you know most of the time we have no idea how other people feel even though we think we do and most of the time we don't even know how we feel I mean our ability to really know what we're really feeling is terrible um and yet we recognize the the broad the broad bins I'm pissed off I'm super happy I'm relaxed I'm tired I mean just think about how coarse that uh that language is for that for all the nuance and all

03:09:19 the underlying things conscious and subconscious that could be driving an emotional state it's really it's really quite unbelievable yeah beyond the veilance that was you know positive versus negative that was about the extent of my emotional language until you know somewhat recently well it strikes me you've come a very long way maybe you could share with us a

little bit about what you learned on these um what you called Retreats or um I mean in in the book chapter you describe um deliberately going off to uh a treatment

03:09:48 center U multiple treatment centers over time to really drill into this process of understanding oneself better and how one's current state of emotional processing and emotional stability are influencing relationships and the key importance of that what was there any kind of overriding um theme for you for instance could you trace back to specific events or themes of childhood that made a lot of it make sense um or is it um far more uh nuanced than that well you know the first thing I would say is I wish I could tell you

03:10:23 that this was a very um deliberate and wonderful choice that I just decided I'm going to go on a little you know self-healing Journey but unfortunately that was not the case uh in both cases in 2017 and in 2020 um I ver l l l was as close to having no choice in the matter as one can have so uh both of these experiences represented um total Rock Bottom moments in my life uh so the these would have been the two lowest points in my life uh for different reasons but but they were nevertheless the two absolute low points

03:10:59 in my life and I would say you know in the first instance l l guess I could have chosen not to go but um I would have lost everything that mattered in my life at that point um and had you know our good friend Paul kti basically telling me um that I needed to do this that I really needed to do this and in the second situation though completely different circumstances you might think how can one person in just a span of three years find themselves in in a situation where they almost without having any choice in

03:11:39 the matter have to go away uh to a place where you're you're basically locked up without a phone for you know three weeks and you're doing 12 to 13 hours of therapy a day um so nothing about this was was something I wanted to do nothing about this was pleasant um I would describe these as the most difficult things I've ever done in my life Bar None and I've done some difficult things in my life but they've always been physically difficult I love doing physically difficult things uh but this was

03:12:13 emotionally the equivalent of for me um you know climbing K2 and swimming the English Channel in the same month you know something that just I could you couldn't fathom um so so with that said yes I learned a lot and I learned that people like me can be overly analytical and that that hyper analytical nature can lead you astray when you think that your intellect is giving you a fact-based explanation for a set of circumstances and you rationalize them away well this happened to me when I was a kid but you know like I get it and

03:13:04 it's not really a problem and as a result of that you know it's uh it's these are actually some positive things that came out of that experience and and and I think the real aha moment in my Journey which occurred um on a on a day that I remember very well was the day I finally dropped that I dropped that um that rationalization and I allowed myself to experience what a child would experience in that moment and then understood what the implications are for a child going through these things and I think that was that was really the

03:13:54 first time in my life I ever accepted emotionally something that I had intellectually always said yeah it doesn't really matter I mean it's just you know that's just life and those things happen and lots of worse things happen to lots of people and and that's okay um and I think it it's not that once I emotionally accepted this I became a victim it wasn't at all it just finally allowed me to realize oh I can let that go now like I I don't have to I I don't have to I don't have to be a slave to the

03:14:27 adaptations that came from that I can I can I can surrender that's um beautiful and um and inspiring to me I think that um yeah there's this uh incredible ability that the human brain has to script a story and to compare to other people's circumstances and as you said you know rationalize what are essentially emotional traumas or physical traumas um from the perspective of the adult but um if I know one thing for sure and make it very clear I'm not a clinician but is that the brain doesn't um discard of any circuitry we

03:15:09 repurpose the same circuitry we used as children as as adults and so the ability to go back to that and to and to par but as you as you point out not from a um from an intellectual stand standpoint but from an emotional standpoint seems to be the the really hard work do you do that on a regular basis no not not at all um it's been done a handful of times um it's been exhausting it's it's very difficult it's it's I don't know if this is the right word I would almost describe it as emotionally violent um

03:15:48 and it's it's it's not something I need to revisit often truthfully I I think that um yeah it's um it's it's been done a finite number of times and I think I've captured so much so much value from it that that there are lots of other things I continue to do I mean I you know I I use a system called dcal behavioral therapy that is a regular part of the therapy that I do um but I don't have to go back to my childhood I don't have to go back to uncovering and and re-exploring a lot of that stuff um I I I've I've learned

03:16:27 the lessons and now it's really about practicing the skills I know I know what I want now and I and I know you know you talk about plasticity I'll share one example which I know I wrote about in the book but but just for for folks listening that you'll appreciate so I you know just one of the one of the Hallmarks of my existence has always been you know just a an insane amount of

anger and rage it's it's been there as long as I've known so I don't have a conscious memory of not having rage right so earliest memories of life

03:17:01 when I'm five years old I have rage like you can't believe and it's it's a problem all my life so as a teenager if I go more than two weeks without punching a hole in the wall of our house it's a miracle I mean I am so good at drywall you can't can't believe how good I am for all the stuff I have to repair around our house like I'm breaking Windows I'm breaking it just doesn't like I just and so in a way and and of course I rationalized how much boxing saved my life because I had this amazing outlet for my rage right if you I got to

03:17:36 basically exercise six hours a day I'm hitting punching bags in people all day long and it's just a beautiful outlet that keeps me out of jail um um and a big part of that rage was inward right so it's it's not rocket science to understand that a person who has that much hatred for everyone has an enormous amount for themselves and so one of the things I didn't realize was happening was what my inner monologue was because as you can appreciate your inner monologue is so frequent and ubiquitous and present

03:18:18 that it's easy to almost forget that it's there I mean that's the that's the that's the sort of uh dangerous part about it right is kind of the you know the David Foster Wallace this is water thing the fish are swimming through water the water is everywhere they don't even realize they're in water you don't unrealized you don't realize the subconscious stream of thoughts that constantly flow but eventually I became aware of just what that self talk was and it is it was no longer the case it was the angriest the most violent self

03:18:57 talk you can imagine I mean it was like there is no mistake that I could make that was anything other than my perfect perfect standard that didn't result in what I would call my inner Bobby KN going ballistic so it just didn't matter like it it sounds silly under it didn't matter if I didn't perfectly cook a steak if I didn't perfectly nail something I was doing if if I didn't do anything that was perfect at what I described as match grade perfect I mean I would want to beat myself to a pulp and I would scream at

03:19:40 myself I mean it just it's it's again it's hard to describe and I I hope that most people listening to this don't understand what that feels like well it became very clear that that had to change because when you are when you are that when you hate yourself that much by definition you are going to be an insufferable prick to everybody else like because you're you're just that's going to spill into how you interact with the world so I you know was working with a therapist who was one of the people who

03:20:15 was sending me to this place in Arizona and basically it became clear that you know they they they they they proposed that I could shed this trait if I was willing to do certain amount of work and I was like there's no chance like I'm 47 years old this is the only way I've ever interacted with myself how in the world could this be undone it would take another 40 years to undo this and they're like no no no here's this exercise you're going to do so the exercise was every single time I did something where I would have that self

03:20:53 talk I would have to immediately stop myself and pretend that it wasn't me that just did that but it was one of my closest friends and instead I would audibly speak to that person there was nobody else there but speak to that person as though they are the one that made the mistake and I were to I was to record that on my phone so if I'm out there shooting my bow and arrow and I'm don't get a bullseye instead of screaming at myself I have to say oh imagine it's my buddy Jr who just missed that shot what would I say to him

03:21:29 pick up the phone or you know pull out the phone and say of course something different and of course what I would say in that situation was much Kinder I mean infinitely Kinder it's like I'm saying it to my closest friend I'm going to say it in a very kind way and I had to take uh a copy of that audio and text it to my therapist oh wow yeah talk about vulnerability I was all on board this practice until you mentioned that at which point and and I trust my therapist uh um to a very deep level but I thought

03:22:00 wow that that's a that's a mountain well this you know this poor person got a lot of text messages a lot lot of audio files but here's the part that just blows my mind it only took I don't know I I can't remember exactly I have to go back to look at my journals only took about four months to get rid of Bobby Knight like you know again we we had kind of a mental model for what this looked like which was Bobby Knight was the chairman of the board he sat in the boardroom and nobody else got to talk

03:22:32 and for those that don't know Bobby Knight had a terrible temper yeah yeah the worst right this is the guy that was throwing chairs across the basketball court level 11 y out of 10 and and all of a sudden like we got to the point where Bobby Knight is not even in the boardroom anymore in fact I as I say this today like I don't really remember what he sounded like I mean it's it's amazing to me and and I've had some really amazing opportunities to bring him back like it's not like I'm making fewer mistakes

03:23:06 right it's not like I'm better today than I was three years ago at all the things that I do I'm not I'm actually probably worse in many regards uh but the difference is you know I can communicate with myself I think I can say this I think I can say lovingly right and and maybe not as lovingly as some people can I I still think I'm probably maybe just a little higher standard with myself

than maybe I need to be at times but but I'm just not beating myself up like I used to and I think by extension I'm beating other

03:23:44 people up a lot less well I don't know the extent to which your internal narrative reflects the uh narrative that others have about you but first of all I want to thank you for sharing um what you just shared I think as a practical step it it um first of all it's one I've never heard of before um but certainly represents this incredible phenomenon of neuroplasticity because four months sounds like a bit of time and yet you were 47 years old that's 47 years of accumulated um just absolutely rating self talk is what it

03:24:18 sounds like um so it's something that people can think about for their own for their own purposes um and their own challenges also you know I've read the book twice now and and love it as as I put in my um endorsement of it um I think it's not just informative but it's indeed important because it centers on so many of the key actionable items related to vit health span and lifespan Vitality longevity whatever people want to call these things that are essential but also this the section on emotional

03:24:54 health was um absolutely profound for me it inspired a huge number of changes um and the book as a whole represents a a very important contribution to everybody there there are numerous points and I would say every chapter is applicable to everybody and there are very few books out there like that um so I want to thank you for that and especially for including the section on emotional health and especially for sharing what you did today because I think it doesn't just take a a bit of vulnerability but a

03:25:28 ton of vulnerability and humility to be able to share what you just shared and my only request or wish is that you also hopefully internalize the tremendous gift that you're giving everybody through coming on podcasts like this doing your own podcast writing the book you know I look out on the landscape of um front-facing public facing um Health out there and uh you sit uh not alone but in a unique stance as the the medical doctor that I do believe that um people trust the very most because of the fact that you have that intense

03:26:04 rigor your I wouldn't even say your desire your um absolute obsession with measurement and and precision um many of the things that a moment ago you were pointing to as as potentially you know hazards for your emotion life but that serve all of us the general public um so preciously and so with it just incalculable value so I hope that internalizes as well maybe uh it'll even weave into your self talk maybe I need to send you a script every day but in all seriousness I also want to thank you for taking the time today and um even

03:26:37 though it's a personal thing I I really want to thank you for your um being an amazing colleague to me in the podcast space in the in the health and Medicine space whatever that is and also um just an an incredible friend you've been a tremendous source of support and guidance in every one of the domains that we talked about today and many more and again I just want to say that this emotional health component I I agree with you I think it's um it's not just vital I think it's it's the the most vital of all of them so um you've just

03:27:10 made numerous important contributions and I'm just want to thank you for sharing you clearly put everything you have into everything you do so thank you Peter Andrew thank you I really appreciate you uh making the time for us to sit down and talk in a long form way which I enjoy and um yeah it's it's an it's an honor and it means a lot to me that you have have read it twice and that you've appreciated it and and uh and praised uh praised it as you have thank you thank you once again for joining me for today's discussion with

03:27:40 Dr Peter AA I hope you learned as much and enjoyed the conversation as much as I did please also check out Dr aa's new book which is releasing on March 28th 2023 entitled outlive the science and art of Longevity if you're learning from Andor enjoying this podcast please subscribe to our YouTube channel that's a terrific zero cost way to support us in addition please subscribe to the podcast on both apple and Spotify and on both apple and Spotify you can also leave us up to a festar review if you

03:28:09 have questions for us or comments about the podcast or topics you'd like me to cover or guests that you'd like me to include on the hubman Lab podcast please put those in the comment section on YouTube I do read all the comments in addition please check out the sponsors mentioned at the beginning and throughout today's episode that's the best way to support this podcast on various episodes of The hubman Lab podcast we discuss supplements while supplements aren't necessary for everybody many people derive tremendous

03:28:34 benefit from them for things like improving sleep supporting hormones improving focus and so on the hubman Lab podcast is proud to have partnered with momentous supplements if you'd like to see the supplements discussed on the hubman Lab podcast you can go to live momentous spelled o us liv.com huberman if you're not already following me on social media it's huberman lab on Instagram Twitter Facebook and Linkedin and at all of those places I cover science and science-based tools some of which overlap with the contents of the

03:29:01 hubman Lab podcast but much of which is distinct from the content covered on the huberman Lab podcast again it's hubman lab on all social media platforms if you haven't already subscribed to the hubman Lab podcast neural network newsletter it's a monthly newsletter that includes free toolkits for things like tool for sleep how to enhance the quality and duration of your

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03:29:26 those toolkits can be found by going to huberman lab.com go to the menu scroll down to newsletter and simply give us your email we do not share your email with anybody and again the newsletters and toolkits are completely zero cost and you will also find some PDF examples of previous toolkits again that's huberman lab.com thank you once again for joining me for today's discussion with Dr Peter IA and last but certainly not least thank you for your interest in science [Music]

00:00:00 welcome to the huberman Lab podcast where we discuss science and science-based tools for everyday [Music] life I'm Andrew huberman and I'm a professor of neurobiology and Ophthalmology at Stanford school of medicine today my guest is Dr Alysa eel Dr eel is a professor of Psychiatry and Behavioral Sciences at the University of California San Francisco she is also the director of the center on Aging metabolism and emotions Dr eel's laboratory focuses on stress and the many impacts that it has on our brain

00:00:32 and body both negative and positive for instance her laboratory has shown that particular forms of stress change our tiir which are a component of the genetic Machinery of our cells that impacts how quickly our cells and therefore we age we also discuss exciting work from Dr eel's laboratory exploring how stress impacts our behavioral choices in particular which foods we elect to eat and how we experience those Foods today you'll learn how stress and your interpretation of your stress impacts the different

00:01:01 aspects of your biology and psychology you'll also learn about several important stress interventions that Dr eel's laboratory has explored including meditation and breath work can profoundly influence the way that stress impacts your brain and body both For Better or For Worse she's also explored how specific dietary interventions such as omega-3 fatty acid intake impacts stress and our response to stress and a key and important feature I believe of Dr eel's work is how stress and stress interventions vary in their

00:01:31 effectiveness depending on whether or not the subjects in her experiments are male versus female and their social status by the end of today's episode I assure you you will have a much more thorough understanding of what stress is and how it changes our biology and psychology as well as the specific stress interventions that are going to be most optimal for you in reducing the negative effects of stress on the aging process and on negative behavioral choices and also how to leverage stress in order to maximize the positive

00:02:00 effects that stress can have on cellular metabolism mental health physical health and performance to learn more about the work from Dr eel's laboratory as well as to learn more about her books entitled the tiir effect and now more recently the stress prescription you can find links to those in the show note captions before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford it is however part of my desire and effort to bring zero cost to Consumer

00:02:26 information about science and science related tools to the General Public in keeping with that theme I'd like to thank the sponsors of today's podcast our first sponsor is thesis thesis makes custom neut tropics and frankly I'm not a fan of the word neut tropics because it translates to Smart drugs and as a neurobiologist I can tell you that our brain has neural circuits and

chemicals that underly for instance our ability to focus or to task switch or to be creative there is no one specific circuit or category of chemicals in the

00:02:55 brain that allow us to be smart thesis understands this and has developed New Tropics that are customized to different types of mental operations what do I mean by that well they have formulas that can put your brain into a state of increased Clarity or Focus or creativity or that can give you more overall energy for things like physical exercise I often take the thesis Clarity formula prior to Long bouts of cognitive work and I'll use their energy formula prior to doing any kind of really

00:03:24 intense physical exercise if you'd like to try your own personalized neut Tropic starter kit go online to taketh thesis. c/h huberman you'll take a brief three-minute quiz and thesis will send you four different formulas to try in your first month again that's take thesis. c/h huberman and if you use the code huberman at checkout you'll get 10% off your order today's episode is also brought To Us by eight sleep eight sleep makes Smart mattress covers with cooling Heating and sleep tracking capacity I've

00:03:52 talked many times before on this podcast on on other podcast about the critical relationship between sleep and body temperature put simply in order order to fall asleep and stay asleep deeply throughout the night your body needs to drop by about 1 to 3° in its core body temperature and conversely waking up involves 1 to 3 degree increases in your core body temperature so it's very important that you control the temperature of your sleeping environment which also includes the temperature of your mattress that's what eight Sleep

00:04:19 mattress covers allow you to do so for instance I tend to run hot during the night so I have my mattress set to be pretty cool at the beginning of the night and then to get progressively cooler and then warm toward morning when I want to wake up and in doing this it's allowed me to really optimize my sleep meaning I sleep much more deeply and I get far more rapid eye movement sleep than I ever did prior to using eight sleep if you'd like to try eight sleep you can go to eights sleep.com huberman

00:04:43 to save \$150 off their pod 3 cover eight sleep currently ships in the USA Canada UK select countries in the EU and Australia again that's eights sleep.com huberman today's episode is also brought To Us by hvmn Ketone IQ Ketone IQ is a supplement that increases blood ketones I think most people out there have heard of the ketogenic diet however most people out there including myself do not follow a ketogenic diet despite not following a ketogenic diet I make it a point to increase my blood ketones

00:05:12 through the use of Ketone IQ the reason for that is that ketones are one of the brain's preferred sources of fuel I find that by taking Ketone IQ I have elevated levels of focus for several hours afterwards it also allows me to do physical training or mental work fasted and in addition to that I focus much better when I take Ketone IQ as opposed to fasted alone so many people like me find that whether or not they follow a ketogenic diet or a more typical diet supplementing with Ketone IQ and thereby

00:05:40 increasing their blood ketones allows them to do more focused mental work and physical work even when fasted or when a bit hungry so if you'd like to try Ketone IQ go to hmn.com and use the code huberman to get 20% off your order again that's hmn.com and use the code huberman to get 20% off the huberman Lab podcast is now partnered with momentous supplements to find the supplements we discuss on the hubman Lab podcast you can go to live momentous spelled o us Liv mous.com huberman and I should just

00:06:09 mention that the library of those supplements is constantly expanding again that's liv.com huberman and now for my discussion with Dr Alyssa eel Dr eel welcome thank you so great to have you here we have colleagues in common and topics of Interest related to our Laboratories in common so got a lot of questions today I'd love to just kick off by you explaining a little bit about the different forms of stress you know we hear stress stress is bad stress can kill us no one likes to feel stressed Etc but as you and I both know that's

00:06:42 not the entire picture so love for you to just educate us a bit on what stress is and what it isn't uh where it can be problematic and where perhaps it can even be beneficial so as a stress scientist it is a word I use a lot but it has to be broken down because it has so many different kind of dimensions and meaning so there's good and bad stress there's acute and chronic stress and you know technically it just means anytime we feel overwhelmed that we feel like the demands are too much for our

00:07:17 resources so that's kind of a a very technical way to put it but really so much of life is about meeting challenges and we're never going to get rid of different stressful situations ations in life if anything they are increasing and so it really comes down to not the stressors of what's happens to us but really how we respond the stress response so that's a distinction that we're still trying to get the field to talk about stress in a more specific way so that we can think about what situations are in your life they might

00:07:52 be difficult ongoing situations like caregiving or work stress or worrying about Health your own or someone's and then there's how are you coping with it so when something happens we mount a stress response and we recover and that's beautiful no harm done we need that that's why we're here still alive is that survival response it's it's a problem these days of just we keep it alive in

our head we keep it alive with our thoughts our thoughts are the most common form of stress even though I expected we would get into

00:08:30 tools to combat stress a little bit later since you have now told us that our thoughts are the biggest um sort of propagator of internal stress what to your knowledge is the best way or what are the best ways for us to manage overthinking and ruminating on stressful topics because I certainly experienced stress and when I do I have tools related to you know breath work running exercise sleep uh non-sleep deep rest I'm huge fan of all these sorts of things but when we succumb to stress and the thinking patterns take over where

00:09:09 the gears are turning and they won't stop turning what does the science tell us about ways to manage those thoughts should we work with them in the sense that we try and rationalize um or understand the basis of the stress or should we try and divert our thinking away or is there some other tool that I'm aware unaware of yes yes both and right so I like to bin it in three um three categories so one is we well I'll just say first of all we have to have some awareness of how our mind works or we're just like

00:09:45 you know a subject to thinking our thoughts are real thinking that it's helpful to keep ruminating and problem solving because that's our tendency is to go toward whatever we think there's threat or risk and to problem solve but you could just be stuck there all day in this kind of threat mode or redm state and that's just a shame we don't need to turn on that stress response all the time but that's where we are as a society so that's why I I wrote the stress prescription take any survey even pre- pandemic and people feel the

00:10:21 majority of people feel an overwhelming amount of stress so even um this past year 46% of adults s report feeling overwhelmed by stress and then you break it down you're like o this is really bad for young adults and women and people of color and so we have these you know groups that are targeted for marginalization that are feeling an extremely high amount of stress in most of those subgroups so bottom wouldn't you argue that most most everyone is feeling more stressed now or is it just or what do the data say yeah

00:10:56 so I think that I think that we're we come with different levels of awareness of our stress and so when I find someone who really doesn't feel a lot of stress sometimes I can see right through that and they're just not aware and sometimes it really is true they they're often in a different stage of life and they control their environment a lot and they've been through a lot I mean one of the big patterns in the population levels of stress is that the older people are less stressed period if you're over 65 you have been

00:11:36 through so much solv so much you just have a better perspective on life and on stressors and then our adults our young adults have like four times the level of stress as our older adults so so we do you know we don't have to wait till we get older but there certainly is true wisdom and resilience that comes with age for many people um often we're so used to feeling daily stress from our Urban and Modern Life that we're we don't notice it we're just used to it and so we're going through the day with

00:12:06 kind of like clenched hands and just you know for listeners just even just taking a check in now and noticing how you might be holding stress in your body that's a huge clue it's a huge place where we accumulate tension so we might not be aware that we're stressed but we're clenching our hands and in fact um my taxi driver who drove me here um let me know that he's exactly that point that he doesn't realize he stress until he realizes that he's tensing his shoulders and his and his fists and so

00:12:42 great signal you know doing a check-in to like notice where in our body we're holding stress is step one to releasing it so um going back to this notion of overthinking what are the tools that um are most efficient for dealing with overthinking or ruminating uh when people just sort can't seem to let go of the thing that's the stress or thinking about not the stress in their body but the thing that caused the stress the difficult conversation the thing that irked them on social media or in their personal

00:13:15 life or professional life or simply out in the world so I I wish I had one answer but I'm going to say lots of strategies tackle that and so in those three bins one our top- down strategies of awareness and things that we can say to ourselves since our beliefs and mindsets can really help us release stress view stress more positively the second bucket is um not that the Mind changes the body but the body changes the mind and those are the set of strategies that you tend to use the most right we're we're we're

00:13:48 working stress out of the body we're metabolizing it we're burning it up and we get relief it changes our you know amygdala activity and moves us to more an experience state where we're more in our somat sensory cortex and then the third uh bucket is change the scene just getting away from all the stress triggers that we have in our office or in um in the city and being in environment that we find calming it might even be just be a corner of the house but implanting what I call safety signals we're just these animals that

00:14:26 are conditioned to signals whether we're aware of it or not so having having things like comforting pets pictures smells music why not we need those they help they add up yeah I like the idea of having a small physical space or I suppose it could be a large physical space but for most people who don't have the resources some small predesignated physical space that um

represents a safe Zone um and uh creating or I should say populating that safe Zone with things as you said um as a visual neuroscientist originally I guess now I

00:15:03 study stress um but uh as a visual neuroscientist we know that photographs are extremely powerful cues for the memory system especially uh actual physical photographs um and I believe there is some work on this that if people keep a photograph of something that draws positive memories that that photograph actually they keep it with them that actually can be a positive cue for um alleviating stress and just enhancing mood um this is probably done less so nowadays because everyone keeps things on their phones and it's just

00:15:34 kind of a scroll through but um in any event you know when we talk about stress uh it's clear that there's short-term medium-term long-term stress you studied all these different forms of stress um if you would be so kind as to just give us an overview of the different forms of stress uh how we can learn to recognize those and then I'd love to transition from there into talking about uh some of the work that you've been doing on stress and stress related eating and stress and how it uh relates to Aging in particular but before we do

00:16:08 that um to get make sure everyone's on the same page um if you could just uh pepper our minds with knowledge about stress in all its um beautiful and um not so beautiful forms so when we think about stress we usually think feeling stress you know reporting stress and that's important what are bodies doing is also important and it's not always related to our mind so measuring levels of the nervous system and how Vigilant we are is another way that we can understand stress and that's particularly important and interesting

00:16:42 because that's how stress gets under the skin we might not be aware we might report stress but we're still holding tension and being much more sympathetically dominated meaning that we're our body is Vigilant and scanning for cues and we don't feel safe and so we're mobilizing a lot more energy than we need to and stress is so expensive to the body the stress response uses a tremendous amount of energy ATP that's made by your mitochondria and if we have that kind of vigilant stress response on all day we're just going to feel

00:17:20 exhausted and we all feel exhausted at the stage of the kind of long shadow of the pandemic and it's really no mystery because we're not good at turning the stress response off and that's what we want to really focus on is understanding we need to mount a big stress response to cope with things when we need extra energy but then we can actually let our body relax and we can turn it off and that's where the rumination comes and we want to catch ourselves rehearsing and reliving stress or worrying about the

00:17:49 next thing saying right now I'm safe and you know there's the breathing strategies I'm right with you where those are the most direct and fast path to reducing stress in the body period yeah our colleague David Spiegel associate chair of Psychiatry at Stanford and also a colleague of yours um as well um has I think said it best which is that breathing is unique among the functions of the brain because it really originates as a brain function and then extends of course to the body in that it represents a bridge between

00:18:22 the conscious and the unconscious because at any given moment we're breathing and of course at any given moment we can take control of our breathing there are very few brain circuits that impact the body in that way like I can't suddenly just change my rate of digestion because I decide to but we can do that with breathing we will definitely get into some of the um work that you've been doing on breath work particular um I know you have a study that's actually explored the Wim Hoff method quite directly one of the

00:18:52 few studies that I'm aware of that's done that so we'll get to that a little bit later um so you describe stress as a way that the body and mind mobilize energy yeah and I didn't quite answer your question so there's there's that acute stress response when everything every hormone and um cell in our body is having a stress response and that is allowing us to reorient focus problem solve it's really beautiful how much we can um increase our capacity to do things during stress and then if it you know lasts minutes or hours we

00:19:29 eventually recover and that is um what happens all day in small you know to small extents with daily stressors we don't necessarily get so threatened that we release a lot of cortisol but our nervous system is going up and down all day then there are then there's kind of moderate stressful events that maybe take days or months to cope with and what's important there is that noticing like right now am I really coping acutely with something or can I restore so that kind of daily restoration is very important and then there are

00:20:05 chronically stressful situations that go on for years many of us not all of us but many of us have those in our life These are situations I'll just use caregiving as an example that we can't change we we can't change other people we can't change certain situations or resources and we can be thinking about them chronically problem solving trying to wish things were different or we can use acceptance radical acceptance strategies and other strategies to live well with them and and so that's a really important

00:20:42 strategy for people who feel like their their life is going to be stressful forever because of X or Y that that's not true you have a harder life you're going to do more coping but you can actually be dealing with with uncontrollable chronic stress in ways that it's not going to take that toll on your body I mean I study chronic stress and how it accelerates cell aging and I can tell

you there's so much variance between people people are so different so among caregivers some of them look as biologically young or younger than our

00:21:17 controls people with no identifiable big tough situation in their life I love to hear about the um lack of inevitability around aging and stret I I realized that there's a big landscape of of discussion around aging and stress for us to cover but since you brought it up um in one of your papers there's a beautiful graph and since a lot of people are listening not watching and we don't use visual diagrams for that reason I'll try and explain this as best I can um you distinguish between optimal aging

00:21:52 typical aging and accelerated aging I think everyone I can imagine would want optimal aging right certainly not accelerated aging and what's interesting about this graph in your paper is that while of course it appears that toxic stress chronically unmitigated stress that's makes us feel like we are at the world's Mercy or the other people's Mercy will accelerate aging turns out that underexposure to stress leads to more rapid aging than what you describe as ideal amounts of stress in other words

00:22:29 words that no stress is not the answer rather to have some stress is ideal if you want to have so-called optimal aging could you maybe explain a little bit about the mechanisms behind that maybe this is a good opportunity also to um tell us about your tiir work um so the questions are how does one measure optimal versus accelerated aging and why would it be that some stress is better than no stress when it comes to aging uh ideally MH so having no stress means we're not really living like we're not

00:23:08 engaging in the gifts of Life which are inevitably have some challenging risk and let me give you an example one study took um elderly people who have retired and they you know Society kind of labels them as you're kind of done with your meaningful work in life and um you're you know you are pretty much not able to contribute to society I mean there's so many negative stereotypes of people then kind of embody and then live um and this program brought them to work in schools and tutor Young At Risk students and

00:23:47 what happened to them is they went from feeling maybe safe and under stressed to feeling challenged but generative they they were feeling more purpose they were feeling like they were growing and they were feeling like their day had more meaning they had more relationships they had these caring relationships with the students the students had all sorts of issues and troubles drugs and and maybe not having lunch poverty and so they felt the stress of that but they also saw how much they could help with their

00:24:24 support and their tutoring and in the study they took images of the hippocampus and those who engaged in the program particularly the men actually had growth of their hippocampus during this program so at any stage in life we can be growing and challenging ourselves even in our much later years and growing our brain and you know more than anyone like what does that hippocampal growth mean for their well-being and their cognitive functioning yeah it's interesting that hippocampus of course a

00:24:55 brain area involved in formation and recall of memories mostly formation of memories um it's super interesting because it's so plastic it's so amenable to the addition of new memories I think the most striking study to me is the one and I should point out that most of the data say that the addition of new neurons is not the main reason for improvements in memory but it is one of them um but Rusty Gage down at the Salk Institute did a study in I think the early 2000s where they took terminally ill people and these people agreed to

00:25:28 have their bodies injected with a Dye that would label new neurons and then after they died their brains were processed um and they didn't die from the D injection by the way folks they died from other causes they were terminally ill and what they discovered was that even in terminally ill or or and some of these people were uh quite old those people were still generating new neurons especially in the context of still trying to learn and acquire new information so wow um course they're dead so they can't apply that

00:26:01 information after that but of course none of us can right none of the information that but why not up to when you die right absolutely absolutely one other example of this my colleague Dave Almeida he measures you know daily stressful events in huge National populations and a small percentage of people report no stressors and so you wonder like what's happening are they not engaging in life are they really not having stressors it looks like they are it's not just that they're not getting stressed by things they're not

00:26:27 they're not really going out doing much and what he found is that their level of kind of memory and cognition their cognitive Health was significantly lower so you can imagine the hippocampal you know the lack of those um neuroprogenitor cells they're just not being stimulated it's super interesting I wasn't aware of that result so I appreciate you sharing it I almost have to wonder if it's like exercise where you know so many people I think now everybody hopefully understands that exercise is going to lower blood

00:26:59 pressure reduce resting heart rate improve muscle skeletal function and bone density all that stuff but that if you took a snapshot of the bodily response during exercise blood pressure is way up heart rate is way up stress hormones are way up cortisol is through the roof during a hard workout and immediately afterwards and yet that sets in motion a series of

adaptations that brings you to a better place most of the time I almost wonder if stress is the same is there any evidence that short bouts of stress provided that

00:27:30 they're managed well meaning that we don't spend the next 24 or 48 Hours ruminating on the stressor but that we're able to move through the stressor and resolve it in some way that that's actually beneficial for us because of the mobilization of energy stores and maybe maybe even changing our threshold for reacting to stressors in the future it's a great question and it's one that I have been chewing on for a while because we we know as you said that physical stressors when they're short and repeated like high-intensity

00:28:01 interval training They are promoting not just aerobic fitness but stress Fitness people feel less rumination less depression less anxiety so they're kind of tuning up the nervous system what about psychological stressors and we we we know two things so one is I do think that there is a level of Engagement with moderate stressors that when we are used to them we get fit and our stress resilience builds meaning we're less threatened by them so let me go deep onto that we can two people can approach

00:28:37 the exact same stressor and one person is having a pretty um overreactive stress response where they basically are feeling their survival is threatened so it's high cortisol High Vaso constriction and uh blood pressure goes up equally in both but the person who's feeling super threatened either their survival or their social survival of their ego their blood pressure went up because of the Vaso constriction the other person who is viewing the same stressor as I can do this this is a great Challenge and opportunity I have

00:29:11 what it takes those types of thoughts generate a different hemodynamic response which is actually more cardiac output so blood pressure is going up but in this healthier way more oxygenation to the brain better problem solving they're able to maintain this positive outlook so we've measured the threat challenge response in many lab studies and we know lots of things so if you're having more of the challenge response at the end of it you're less inflamed so just in the lab within an hour or two we

00:29:39 see that they they didn't trigger all that pro-inflammatory response and their ters tend to be longer which is a measure we can talk more about but basically it looks like they have a slower speed of Aging that is super interesting you call this a stress uh challenge resp response so we could call this kind of a um two to be really simplistic two types of psychological stress response feeling threatened like you're going to fail you're embarrassed um you know that social pain response we know well that

00:30:14 feels terrible um but that also that huge stress response when we you know we feel it in our stomach our heart is pounding it's just an ere exaggerated response that response biologically is different and the thoughts that go with it are different and we recover a lot slower and then there's the challenge response which is this it's more of that kind of activated um excited response and the beauty is that there are lots of studies out there done by emotions and social psychologists that tilt people toward

00:30:49 the challenge response we can actually promote that challenge response and so when you asked about like is it good to have a repeated stress response yes if it's if it's manageable right then we're kind of building the muscle of stress resilience I'd like to take a quick break and acknowledge one of our sponsors athletic greens athletic greens now called ag1 is a vitamin mineral probiotic drink that covers all of your foundational nutritional needs I've been taking athletic green since 2012 so I'm

00:31:20 delighted that they're sponsoring the podcast the reason I started taking athletic greens and the reason I still take athletic greens once or usually twice a day is that it gets me the probiotics that I need for gut health our gut is very important it's populated by gut microbiota that communicate with the brain the immune system and basically all the biological systems of our body to strongly impact our immediate and long-term health and those probiotics and athletic greens are optimal and vital for microbiotic health

00:31:48 in addition athletic greens contains a number of adaptogens vitamins and minerals that make sure that all of my foundational nutritional needs are met and it tastes great if you'd like to try athletic greens you can go to athletic greens.com huberman and they'll give you five free travel packs that make it really easy to mix up athletic greens while you're on the road in the car on the plane Etc and they'll give you a year supply of vitamin D3 K2 again that's athletic greens.com huberman to get the five free

00:32:15 travel packs and the year supply of vitamin D3 K2 what are the sorts of things that people I can do in order including me I should say um can do in order to um wage that challenge response is this purely based on mindset like instead of saying why me why this why now I can't believe this is happening is it a mental pivot to okay this is a great opportunity for growth I don't know how I'm going to manage this but I'll manage this um you know you want to stop me you got to kill me type of type of mindset is that is that the the

00:32:53 switch that then the body follows because this is an interesting instance where the uh most all the stress mitigation work that my lab does is focused on using the body to control the mind but here we're talking about the Mind controlling the body first and then the body following suit which I find um equally fascinating um so are there some specific mental scripts that people

follow and are we all able to follow those those scripts yes to some extent we control the script we can use that script to prepare ourselves going into a

00:33:27 stressful situation and we can use it at any point during the stress or so some of us are just wired to have a big threat response period maybe it's you know it's h epigenetics we've inherited maybe it's tra early trauma that has shaped us to be ex have this exaggerated emotional response and yes we and others have found that trauma sensitizes our emotional stress response so that we are feeling more threatened but that's okay because that's the part we can't control and we just have to have a lot of

00:33:56 self-compassion and awareness that okay this is what I do my body reacts like this but what happens next that's when we can start to use those statements self-comforting self-compassion distancing there's all sorts of statements that allow us to then recover more quickly so when we want to shift from a uh threatened response to a kind of challenge response are there any data that dictate whether whether or not we should keep those statements in our head write them down say them out loud I guess what I'm

00:34:34 trying to do here is trying to get to a little bit more of the the meat of the the actionable since since a lot of our listeners I think we'll be um as I am very excited about the idea that a mere shift in our mentality about stress can give us the opposite outcome I mean before you were talking about Vaso constriction and inflammation and all these bad things to um put it lightly and then in the challenge response to stress getting the exact opposite more vasodilation more resources used and

00:35:04 more positive effects on the brain and body so what are some um if if you can recall from the papers if not that's fine but I'm just curious what what those specific tools might every statement you said Andrew is good it's a good one the whole trick here is that people need to find the the strength statements the stress Shields I call them that fit them that that feels right and that they believe and so they I know I list a bunch of options in chapter 3 which is called be the lion instead of the gazelle so the the Li and gazelle

00:35:38 are both you know high blood pressure high stress and the Lion's chasing the gazelle but the G gazelle's having this total threat basal constriction response because um she might die lion might get dinner right so it's needing to mount the stress response because it's so excited to get the tasty dinner for you know the next few days and so the lion is having that challenge response and so we can remind ourselves be the lion we it's it's not that we're always Ling or gazelle we get to shape that and so some

00:36:09 of those statements are well let's say right when when we're going into it list your resources why have you ever dealt with any situation like this remind yourself of past successes remind yourself of someone you can call or text or feel supported by remind yourself that this outcome is not going to effect your life in 10 years or five years that's a distancing kind of um perspective taking so there's all these strategies and and you got to use what works for you telling yourself I got this I can do it I can get through it I

00:36:41 have what it takes those are all good Shields and another set is you know we some of us feel really stressed out by stress like once we get feel our heart racing that leads to oh no you know this is bad for me and so rather than getting stressed by stress we actually want to remind ourselves that this stress response is empowering this is going to help me cope my body is excited my body is doing just what it should right now so that reframing in Studies by Wendy Mendes and others my my colleagues who do this reappraisal

00:37:20 research they have basically train people to view stress as positive during the stressful situations in the lab people do better they perform better they feel more positive emotion they problem solve better they recover more quickly so pretty powerful stuff yeah that is powerful stuff I'm wondering if we can talk about the relationship between stress and eating and I think that's also a great opportunity for us to talk about the opioid system a lot of people are familiar with the so-called um opioid epidemic and opioid crisis um you

00:37:53 know sadly you know far too many people are dying a feny overdose and we all know about the oxy conton epidemic and all these people addicted to opioids and um that's not really what this is about um what we're about to talk about is the fact that we have an opioid system within us that is neurons and other cell types that can red excuse me can release substances into our brain and body that make us feel less pain and make us feel sedated but at a healthy level right and yet there are a lot of things besides

00:38:28 drugs that can activate this opioid system um I think sex activates the endogenous opioid system as far as I last read there was a paper out recently but also food can do it um and again to healthy levels um provided the context is healthy of course what is the relationship between stress and eating and eating and the opioid system stress and eating is an interesting one so most people when they feel stressed or you know I'm just going to ask you do you eat more or less when you're stressed less definitely I feel

00:39:03 like I can go two three days without food when I'm when I'm really stressed but I came up in a profession where um sadly for me all nighters were part of the regular until pretty recently a couple years ago when I just called an end to that um and no it wasn't just because of procrastination it was just work overload um but I can go a long period of time without eating

although I love to eat mhm uh so I do point out that I do love to eat and what does the body feel like when you're in that stress State when you're not even hungry

00:39:34 you're kind of shut down in your digestion that I have enough energy from my neural resources from adrenaline and generally those periods of time when I'm not hungry coincide with a uh hyperfocus on the stressor the deadline whatever it is in life that that needs tending to and um food just doesn't appeal to me as much it doesn't taste as good and it's not as enticing yeah so we think that your type of um body temperament is high sympathetic and so when you have a big stress response your digestion is is

00:40:11 pretty much shut down like it's would be the opposite eating would be the opposite of what your body is telling you to do I should I'm just going to forgive me for interrupting uh for those of you hearing sympathetic we're we're not talking about sympathy we're talking about the the sympathetic arm of the autonomic nervous system which is the so-call fight ORF flight arm as opposed to the parasympathetic in any event sorry to interrupt but want to make sure that um sometimes people hear sympathy

00:40:33 and then they think emotional sympathy um I like to think I have that too but um okay so I so I tend to lean more towards the sympathetic meaning um more alertness arousal yeah on the Seesaw of the autonomic nervous system and I I'm a High um sympathetic Rector I lose weight when I go through like writing my dissertation I look like a skeleton at the end um but that's not what most people complain about it's not weight loss most people complain about overeating or binge eating when they're emotional when they're stressed and so

00:41:04 that's the more common pattern and what that looks different both in the brain and biologically and so what it looks like is that the stress response is driving cravings and also let's say high insulin or an an insulin resistance State and what goes along with that is tending to be over away or have obesity and so just by whe whether it's through conditioning or genetics having that kind of larger body with a big stress eating temperament that is a challenge in life and I've been you know I've worked with

00:41:42 people with different eating conditions Eating Disorders Bing eating and it is a um what's hard about it is number one it's very common and normative to just feel like you can't feel safe iated so it's this compulsive eating tendency that stress brings you to and so the so what it mean we measure this it's very easy to measure it means that people feel like um they can't control their eating they don't get full um they think about food a lot and so stress kind of exacerbates that tendency and that is a

00:42:20 you know it's a it's a common phenotype like we've studied it and maybe 50% of people with obesity have that um do lean people have that some not many like less than 20% but what they also have is this tremendous kind of uh diet what we call dietary strand or control over their eating so they're they are able to to um not overeat even though they're thinking about food a lot so that's that is you know that explains that unusual body of someone who's really more um still has those compulsive traits so why does this matter this

00:42:57 makes it really hard to eat well because when you're stressed you're D you're craving the comfort food the high fat high sugar high salt uh depending on your temperament and that is that means with repeated bouts of stress you're just going to be gaining weight and particularly in the intraabdominal area that's what we've seen we've seen it cross-sectionally we've seen it in Rat studies and mice studies and now we've seen it in people in many St for about 10 years I studied this and the question was is what's

00:43:26 happening in people people the same thing that's happening in mice if you stress them out and you give them Oreos the mice develop binge eating they get really compulsive and they get this you know terrible metabolic Health profile metabolic syndrome where they're they're round you know their in their belly fat basically expands like a cushion and that's because that's this really good immediate source of energy during stress so like we're really well-wired to if our body thinks we're under chronic

00:43:53 stress we're going to store stress fat or abdominal fat so we can mobilize that in a second and then the second question we've asked is can you reverse that with different interventions can you can you block the compulsive eating um so I can I can tell you what we found there but the opioid system that you mentioned is certainly involved and in studies with um people lean people and people with obesity my colleague Raji sinat yel it's basically found that when you stress them out people with obesity are having

00:44:27 a different reward response and they're having they're the more insulin resistant they are the more their Reward Center lights up during stress and what's causal there like what's the chicken what's the egg so because I can imagine these were people that at one time were not obese who got stressed um the opioid system reacted in a particularly uh potent way to food and they were able to clamp their stress and so then they become or binge eaters in the context of stress yeah um and that leads to insulin insensitivity exactly I

00:45:05 could also imagine that they were insulin and sensitive therefore they need to eat more in order to feel kind of an increase in uh satiety because we know this um now uh B based on brain and body mechanisms and then that set off a Cascade of things leading to obesity um not that it necessarily matters but what's causal do we know if I think it really does matter I think there's

been a you know a mistake of kind of confounding all obesity with food addiction and um and metabolic disease and it's completely heterogenous so II

00:45:40 think it's the developmental path that you're describing which is that um there's a tendency toward having bigger reward response and hunger during stress so it becomes a way of coping a lifestyle and and that is a pathway toward obesity and so some obese people have a disregulated stress response but I but not all of them I mean it really is a certain type of person so that's why we target people with Cravings in all of our intervention studies now we want to know who has more of the compulsive eating type because

00:46:15 they need a different set of skills to cope with stress and to lose weight if that's their goal there's a drug I'm sure you're familiar with nxone which is can block the opioid receptor it's used to block the opioid receptor in the context of different types of addiction have people tried to use ultraone in the context of binge eating and does it help people lose weight because it presumably reduces some of the rewarding properties of food that's one of the very few drug combinations that has been used for Bing

00:46:48 eting so it was a combination of nxone and Wellbutrin and I'm not sure at this moment how much um that's favored for Bing eating but certainly the early trials showed that it it really does damp down on the compulsive eating interesting so is that a commonly prescribed uh kit of drugs now for for obesity I know there's a lot of excitement nowadays about these semaglutide yeah um analogs because they do seem very effective in blocking hunger especially in type two diabetics I don't know if you're familiar with but

00:47:17 right there s of all the rage um mostly because people saw the before and after photos of Elon he had his shirt off on a boat and there were some not so nice comments made about him and then sometime later he was quite a bit lighter and um he announced that he had been taking one of these semaglutide agonists yeah yeah I really hope that we come up with um safe and effective drugs and one thing to think about is that the the challenge that we all have um particularly if we're prone to obesity is the toxic food environment and

00:47:48 particularly the refined sugar and regardless of what we're on Metformin or one of these drugs we override it with our diet and and really the improved nutrition is the only way to solve it as a public health problem I mean the drug companies are saying everyone should be you know everyone with a certain BMI should be on one of these new drugs and it's just rubbish and it's not going to lead to long-term Health well I I know you have a colleague there at UCSF um Dr Robert lustig who's been talking about

00:48:16 sugars and hidden sugars for years and the problems with that and we don't want to demonize sugar is the only cause of the Obesity epidemic but it's certainly one of them at least that that's my belief to the data yes and and Rob is the biggest proponent of you know of helping people understand the big problem in the root is in the processed food and the sugar and that the drugs don't touch that we just we override effects of any drugs with our diet and and so it's um it's been a a losing battle really because of the force of

00:48:53 big food and big Pharma so let me go back to the the compulsive eating so we've we've we've um there are some clues about how to break that cycle so one is in our weight loss trials or healthy mindful eating trials we find that mindful eating is not going to cause a lot of weight loss period but the people who benefit most from learning this kind of calm self-regulation where you check in with your hunger you slow down you increase your awareness of your body so interceptive awareness that um type of skill is really critical

00:49:33 for people with compulsive eating and so in our trials we find that if they people with compulsive eating if they get that if they get randomized to the mindful eating they do better in terms of their insulin resistance and their glucose and their long-term weight loss so that's one good clue and another is the positive stress pathway looks important for breaking the compulsive eating cycle so EX high-intensity interval training or you know maybe um some of these other ways that we've been talking about to increase the Bly

00:50:05 stress in these short-term ways to metabolize stress in our body can help with the Cravings so what would that look like in the context of let's say somebody um has the opposite phenotype to me they get stress and they find themselves reaching for snack food or that they simply can't reach satiety they just want to eat and eat and eat um what are some of the aside from n treone and W Butrin and some of these Pres approaches because I always say while I value certainly value prescription drugs in certain context I always feel like

00:50:34 Behavior should come first dos and don'ts then nutrition then supplementation and then if and only if it's still needed prescription drugs but that's just my bias based on my observation reasonable I like to think so uh it also is a uh it starts at a zero cost um Endeavor I mean behaviors require time but it certainly um includes everybody not just those that have insurance or that live in a particular region of the US or the world so anyway um that's my bias and at least for the time being I'm sticking with it

00:51:06 um it's the basis of a lot of what we talk about on this podcast but nonetheless if somebody is uh finding themselves in that category of of binge eating or heading towards binge eating or using food to comfort or alleviate stress how should they intervene in their own thoughts and behavior we talked about the the bins top down strategies changing the body changing the

scene we need all of those I mean the the compulsive drive to eat is one of our you know strongest impulses if we've developed that pathway and so the

00:51:41 we train people for example in mindful awareness of separating out emotions from Hunger so they get really wrapped up together so just labeling how you're feeling labeling your H hunger from one to 10 and figuring out is it am I really hungry or as a boredom that helps people and if you do that checkin right before you eat that helps the most so that's the top down mindful check-in the uh other thing we help people do is like ride the craving surf the herbs so we deal a lot with soda Drinkers and it is

00:52:16 addictive and there is nothing worse than drinking sugared soda for our body so we help people by help um having them water watch their craving pass and and knowing that it's a matter of time that they can surf the urge without jumping to consuming and so that practice helps some people especially with practice the push-ups the taking a walk the changing the scene getting away from food is always going to be a huge strong strategy if you can get yourself away from it the the problem is as you know

00:52:52 is that the Cravings get you to the buffet they drive you to the the soda ET and so just you know creating safe environments both at home and in the workplace where you don't have soda is really important so we tried that at UCSF my colleagues and I um including Rob lastig the anti-sugar doctor we just saw the absurdity of being a medical center people come with these chronic diseases and what are they served in the cafeteria or even at their bedside sugared Coke in the hospital in the hospital and so my colleague laor

00:53:27 Schmidt who's uh partly responsible for the soda tax she rallied the all the um we went top down to Administration but bottom up to vendors got rid of all the soda in all of our hospitals and campuses and we found two things number one people who were heavy drinkers lost weight in the most important Place their waste heavy soda drinkers mhm so when we took it out of the workplace they actually their health improved and number two those with compulsive eating they score high on our our little scale for um reward-based

00:54:07 drive it didn't help them so then we randomized half of them to get some extra boost we call it motivational interviewing where we're really supporting them more and helping them you know think of goals like being with their grandchildren not getting diabetes and and that little bit of support helped them TR tremendously and so now we're trying to roll that out in you know a big controlled trial but at least 100 hospitals have adopted the um stop selling sugary drinks because people don't want to be sick but they can't

00:54:41 help it if they have the reward drive and if they have the compulsivity and it's right there at work we're just working against Health that's super interesting I I think that um for most of us we think about soda as the kind of thing that maybe we have every once in a while or that we drank more when we were kids I seem to have lost my appetite for soda at some point you just know too much teen years maybe or just at some point I I I started to feel like there were better Alternatives um and you know like what

00:55:12 well okay well people want ideas yeah well full confession I mean okay most of my nonwater uh beverage consumption is going to be either coffee um usually black coffee or nowadays I sometimes we throw some ketones in there not cuz I'm on a ketogenic diet but for I do feel like it makes my uh level of focus and cognition better pouring in this morning yeah I do use it before podcast and we're prepping for podcast it it um there are good data showing that uh we can all utilize ketones as a as a brain

00:55:43 fuel even if we're not on ketogenic diet that's um clear to me based on my experience and the data as I see them and understand them um or Yer bate tea which is just a caffeinated uh tea from um South America which I like very much um however I am guilty of drinking the occasional diet soda every once in a while and I know that you know some of my audience will just gasp how could I do that but we're talking about the occasional diet coke diet soda the occasional Diet Coke mostly because I I don't like the taste of sugary soda and

00:56:14 I actually really like the taste of diet soda Aspartame is a particularly rewarding taste for me um and as a consequence I try and avoid drinking it more than I might have a can of Diet Coke once a month maximum usually on a plane or something like that so that's the extent of it but if I have the choice between a really great coffee and a soda it's going to be coffee or yerbamate and a soda it's gonna be yerbamate um or food and soda I'm going to eat instead and so that's me but I do recall you know as a teenager soda was

00:56:48 kind of a default you just kind of like go to the soda fountain and fill the drink it felt like such a rewarding thing um and I think the reason we're drilling into this more deeply is it sounds to me based on what you said earlier in my read of the literature also brings me the idea that that drinking sugar in the form of liquid is one of the worst things that we can do in terms of our bodily regulation of insulin and glucose um it's I don't want to use the words empty calories because that's kind of a loaded

00:57:14 phrase but it is essentially empty calories it doesn't well it's harmful calories they're not empty yeah I mean there no amino acids in there they're no essential fatty acids and there aren't many carbohydrates you can really utilize for um long-term bouts of mental or physical work so so do you view soda as one of the um the worst certainly not the best but one of the worst

culprits out there I mean it is really prominent especially nowadays also we should include energy drinks a lot of kids especially males by the way it's it's

00:57:43 almost this is crazy it's almost 95% of energy drink consumption is males interesting and I don't know what what is maybe it's the packaging or who how the marketing has been pitched but by the way as soon as I say that someone will be in the YouTube comments telling me that that's completely false but we can point you to the data um so what are your thoughts on sugary drinks and what that's doing um how it do you think this is a reaction to how much stress people people are experiencing is this like

00:58:11 people's attempt to to inoculate their stress or is it simply that it tastes good and it's easy to consume and it's relatively inexpensive people have not and we have not really studied the sugary drinks in the same way we have studied the comfort food and the binge eating and so um my guess is that it is part of a stress response but even more than that it's part of the hedonic cycle so when you get the sugar especially if it's packed with caffeine that's going to be a more addictive drink you get this you know

00:58:47 really feel-good response right away and then you get the low and it's the hedonic withdrawal so which is this you actually feel bad when it's been a while since you've had it and so then it drives the compulsivity you want it again because you want to not because you want to feel good you want to get rid of feeling bad so that's what happens with both food addiction and we think that happens with sugary drinks now let me tell you that when you asked is is a sugary drink one of the worst things we can do for our health yes

00:59:17 because sugary food doesn't go to our brain as quickly as a liquid liquid sugar a sugary drink so think about cocaine and crack crack goes to the brain immediately and it's that much more addictive that's how we think of liquid sugar The View on sugar I think is starting to change and I think in the years to come provided um folks like you and Dr Lustig continue to uh be vocal about it which I hope you will um I think it's going to shift things quite a bit I look at it a little bit like trans fats you know I was growing up people

00:59:53 ate margarine and now like trans fats are banned in many cities um it's kind of incredible how these things have changed um over time and it requires an effort not just on social media but podcast and I think also lobbying uh lobbying our politicians really getting them to understand um just how precious the stuff is there's a lot of social norms that go into like what's good for all of us as a group or community and what's personal choice it's very fiery you know I just heard uh colleague talking about

01:00:25 how bringing junk food or soda to work is like passive smoking you're like you're bringing something in that's going to pollute other people's health and you shouldn't do it so that's that's much more edgy and people will fight them on that um but the the basic reality is yeah we're going to eat the donuts if they're in front of us and so in it is much more considerate to bring a bowl of fruit I do love a good donut every once a while myute a certain circuit in my brain I'm glad you brought up smoking I

01:00:53 don't want to take us off topic but as long as we're venturing into these general or I should say more General and yet really important themes around public health and food you know I learned something interesting about smoking and why so few people now smoke um I always thought that the campaigns around smoking and how terrible it is for us showing pictures of lungs that are you know caked with all this tar and like you know cancer and all this stuff was the effective message but what I learned was that one of the most

01:01:24 effective messaging systems in the in the battle against smoking was to get young people to stop smoking not by telling them it was bad for them but by showing them videos of these um rich men sitting around tables cackling about the fact that they're making so much money on the health problems of other people because of smoking in other words what they did is they made being a non-smoker anti-establishment MH and so I find it very interesting anytime there's something like soda or highly processed

01:01:55 foods that are so woven into the establishment it seems like the you can we can tell people until you know we're bleue in the face about all the health concerns with with these things you know sugar is bad and this is bad highly processed food is bad some people might change their behavior but it seems like for the younger generation the thing that's most effective is to activate their sense of rebellion this has been true for probably hundreds of thousands of years but it's certainly true in the

01:02:20 last hundred years and let them see that there is a very strong um big food sometimes big Pharma but certainly big food system that is working against them and that it in order to take control of their health actually we want to activate their sense of rebellion so that they're like no I'm going to take excellent care of myself I'm not going to fall victim to this monetary scheme and here I'm not pointing to any conspiracy I mean this has been seen with smoking this has been seen with a number of different

01:02:46 Pharmaceuticals again not all Pharmaceuticals are bad this is true of a number of different aspects of of kind of Big Marketing absolutely it's like pull the blinders off let people know that we're vulnerable to all the marketing and that there's there really are suppression of data behind a lot of it so it had it's happening with um with eating disorders too Eric stce who's at at

Stanford with you has been using this method we call it dissonance showing people with eating disorders how the food industry has been manipulative and

01:03:18 has tried to design foods for addiction for the highest bang for the buck with dopamine Etc and so that has helped reduce eating disorders in these studies and it has even helped reduce reward drive that isn't that amazing that the dissonance could do that so interesting yeah I think uh what it's telling us is that um few things are as strong as the um no I won't I refuse to response in terms of changing behavior um especially when there's something to push against so it's not just a battle with ourselves I

01:03:53 want the soda but I'm not going to drink it and it becomes a well I want it but I want it because you are making me think I want it I don't actually want that so um I don't know maybe this is getting me back into my teenage mindset but I think a sense of rebellion provided it's in the direction of Health one's own health and the health of others of course um can be a positive thing yeah well we do that with the mindful eating we really we have them bring in the junkiest processed food they can think of like a

01:04:17 Twinkie and eat that really slowly and mindfully and few people finish it they're like that actually wasn't nearly as good as the picture of it and the idea of it and so it's like that reward predictive error that you've talked about where they they think the brain is driving them to have it because of the advertising and their expectation that they'll feel good but if they're really paying attention it's that it's a very disappointing experience versus we also have people Savor a piece of good

01:04:48 chocolate whichever they like milk or dark and that experience teaches them to eat slowly and really enjoy small amounts of rewarding food so that they're not they don't need to feel full and binge oh so interesting um dark or milk chocolate dark yeah like us I actually like the 100% chocolate there's one brand of Venezuelan chocolate that's 100% which sound it might sound awful but it's actually quite good it has it I think that was the first time I could actually taste the the real elements of

01:05:20 chocolate interesting yeah that is not rewarding it's way too bitter for me I need the mouth feel you know give me some fat in it oh my well yeah it's hard to find but um it's out there I'd like to just take a brief moment and thank one of our podcast sponsors which is insid tracker inside tracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work

01:05:45 done for the simple reason that blood work is the only way that you can monitor the markers such as hormone markers lipids metabolic factors Etc that impact your immediate and long-term Health one one major challenge with blood work however is that most of the time it does not come back with any information about what to do in order to move the values for hormones metabolic factors lipids Etc into the ranges that you want with insid tracker changing those values becomes very straightforward because it has a

01:06:12 personalized dashboard that you can use to address the nutrition-based behavior-based supplement based approaches that you can use in order to move those values into the ranges that are optimal for you Your vitality and your longevity inside tracker now includes a measurement of APO lipoprotein B so-call apob in their ultimate plan apob is a key marker of cardiovascular health and therefore there's extreme value to knowing your apob levels if you'd like to try insid tracker you can go to insid tracker.com

01:06:40 huberman to get 20% off any of insid tracker's plans again that's insid tracker.com huberman to get 20% off so while we're talking about stress eating obesity and um here we've also broaden the discussion to include different Generations we're talking about teens and adults um I'd love for you to share with us your findings around this study that you did of pregnant women and how stress and pregnancy and different patterns of eating and uh physiological changes that people experience during pregnancy uh could you share with us

01:07:15 what those findings were because I think those are relevant not just to people who are pregnant or planning to become pregnant but to everybody because I think they shed light on how we manage stress and sometimes how we fail to manage yeah so with overweight and obesity we know we can't just change calories it's just not going to work the next stressful events going to come along and people will you know go back to what their brain is driving them to do is to you know binge on comfort food and so

01:07:42 we've done these interventions with uh men and women that show that we can help them regulate using some of these mindful eating strategies checking in we wanted to do this with pregnant women because when you have excess weight and you're pregnant you're really vulnerable to gaining excessive weight during pregnancy which is not healthy for the mom or the the The Offspring so we we did this study it took us probably 10 years total to you know get the Grand and recruit groups of 10 women who are

01:08:16 pregnant in the same stage and give them this training in mindful eating mindful nutrition stress reduction and then my colleague Nikki B bush has been following the babies for I think it's been almost 10 years since then and here's what we found first of all we couldn't stop excess weight gain the women in the control group gained about about 60% of them gained excess

weight during pregnancy and same with our mindful group so maybe it's end of story you'd stop there and say it fails don't do it there have been so many beautiful

01:08:52 developments in the women who got the training that we we just keep are you know being shocked by how impactful this stress reduction training was it was just two months of their life but but pregnancy is a very critical period when these women were uh changing their habits and they're very motivated to help their baby so here's what we found within that first month of the intervention they all got this oral glucose tolerance test so they all got a they got a blood test to see how well their body was metabolizing food sugar

01:09:24 and so it's like a by diabetes test and what we found was that twice as many women in the no treatment control group had impaired glucose tolerance during pregnancy it's a it's a common high risk and half that many women had this in the mindfulness group so by reducing stress they improved their insulin sensitivity during pregnancy so imagine what that's doing to the baby too then the babies have come out with less obesity less illnesses in their first year of life and more of this kind of healthy

01:10:01 stress response when they've been stressed out in the lab study and so then 10 eight years later we looked at the mental health of the mom so right after the intervention eight weeks later everyone in our mindfulness stress Direction group felt great they felt less depressed they had less stress and less anxiety that's what you'd expect right I mean they just gone to a weekly class they got all the support but eight years later they still showed improved mental health every year that we measured them they still looked

01:10:31 better so it's probably one of the longest studies looking at long-term effects of a mindfulness training and I don't think it was a coincidence that was during pregnancy I think this is a very important time to have these skills and being in a group adds that social support piece that we know is powerful it's an incredible result uh could you share with us what the mindfulness intervention was and when it was initiated when it was stopped so we're talking about 10 minutes a day of meditation as many details as you can

01:10:59 possibly give us because I know um even though I don't think I'll ever be pregnant um I don't plan on it and uh uh you never know well um yeah High 0 minus one probability in my mind but anyway maybe other people have other ideas for me but um zero minus one probability in my mind and yet I'm very interested in this mindfulness intervention because it sounds like a very potent one mhm um so much so that it's multi having a multigenerational impact so how many minutes a day um how many days per week um we had them they

01:11:35 met once a week we they had little reminder cards I mean we need all the reminders we can you know Post-its on the fridge timers in our phone to do this mindful check-in and so they were during the week doing this check-in and it was simply um a a mindful check in closing their eyes and feeling their body feeling their labeling their emotions so it was mindful breathing and then it was some movement and we taught them prenatal yoga but really any mindbody movement people like different things there's

01:12:09 Chiang um there's there's um even just slow walking would have worked um so it was uh mindful check-in breathe move my body that's what the reminder card Said So Close Your Eyes and look inside do slow breathing they also put their hands on their belly and so they felt that they were taking care of their baby and then more movement so they they did increase their walking and the mindful checkins are as we were talking about at the very beginning I would say necessary but not sufficient we've got to stop during the

01:12:50 day and check in and look inside if we're not aware of where our mind is we are just subject to the you know believing the stressful thoughts thinking that we need to keep ruminating their sticky thoughts so the mindful checken is really important and then I think the breathing as we've talked about is is probably the more direct way that they're influencing the prenatal environment the uterine environment to reduce the stress in that the baby's being exposed to and the movement refocuses us from

01:13:23 our mind and our ruminative thoughts to the experiences to what we feel in the body there's even been a study that showed that overweight people with a lot of Cravings if they do the body scan that's simply focusing on the body from the head to the toe you know just reminding ourselves to focus on each part of the body breathe into it release tension it's very basic and simple the body scan significantly reduced Cravings I mean to me that's it's really hard to reduce cravings so like just that refocusing on the body took away

01:14:00 stress anxiety self-referential thoughts that kind of our favorite topic thinking about ourself thinking negative thoughts about oursel to relaxing feeling ease feeling well-being I can't help but ask about what that body skin might have been doing at a little bit more of a me mechanistic level um some of the listeners might be familiar with these terms but some won't so I'll just um briefly Define them uh we can perceive things in terms of exteroception or basically paying attention to and focusing on things beyond the confines

01:14:30 of our skin or interception I I realize you know all this uh but for their sake um no one really understands interception go for it so an interception essentially the sensory the sensory ination of the of the internal organs of our own skin that includes proception and which is our knowledge or our sense of where our limbs are where we are relative to gravity all that stuff and you

know it raises this body scan result that that is the fact that a brief body scan can reduce Cravings raises this question in my mind which is

01:15:01 is craving a um heighten sense of interception or heighten sense of extra reception so I could think of one form of craving where for instance the dut again donuts for me is in front of me and I'm thinking that I want that and so I'm almost in complete exteroception but I'm Tethered to it like my internal world is Tethered to the dut it's almost like the dut is in control of me briefly okay and then I eat it um but it's hijacked your prefrontal cortex it's it's hijacked everything yeah and then if I do a body scan so I'm putting

01:15:33 myself in this experiment in it's kind of uh hypothetical scenario I'm putting myself into this experiment I do a body scan which without question is Shifting me more towards interoception right I'm focusing on my skin my heart rate all these things interception so I could see how that would draw my attention off of the external stimulus and reduce craving and that makes me wonder whether or not craving is a form of exteroception where our interception is just exquisitely locked to exteroception and if so you know because

01:16:09 I do think this is a remarkable result it is very hard to stop Cravings I mean we had a guest on here a former colleague of mine at at Stanford who's now the chair of neur surgery at open uh School of Medicine which is Casey Halper I mean they do they literally drill down through the skull of people who have been cheating disorder and start stimulating different brain areas because these people are so out of control in terms of their binge eating I mean that's the kind of intervention that is considered necessary for a lot

01:16:34 of folks who binge so here you're telling me a body scan in some individuals can reduce that and I have to wonder whether or not it's um somehow breaking that inter receptive EXT receptive tether anyway um I'm speculating here but I'd love your thoughts on on Bing on craving and binging and breaking binging um do you think that there are behavioral interventions um that could be layered on top of body scans should we all be doing body scans routinely yes why not you know and some people aren't going to

01:17:04 like that lying down is maybe not comfortable and so any Mind Body activity is going to do the same it's going to be you know I think breaking that link that you talked about yeah I I find this whole interceptive EXT receptive balance thing um one of the more interesting conversations these days in Neuroscience because we're starting finally starting to understand what some of the the circuitries are and they do link to these reward Pathways in any event um getting back to the relationship between stress and food and

01:17:32 maybe even just weaving back a little bit to the uh opioid system have there been any long-term studies of stress intervention you know in the studies that we do in our laboratory we get people for a month they do one intervention we swap them to another intervention a month we analyze data takes a couple years to do all that but we write papers and we move on um sounds like your lab labatory has been involved in doing a lot of studies where you're examining people over a very long period of time even their children uh

01:18:01 what can we learn about the long-term outcomes of things like body scans meditation and then we'll get into breath work there haven't been that many long-term studies of stress interventions now that you mention it I think the meditation studies are probably the best example there are some studies that have either followed people who have um taken up medic meditation or just these cross-sectional studies where you compare a long-term meditator to someone who's never meditated and they they are interesting I mean let's talk

01:18:35 about the cross-sectional studies you're already you know studying someone who eats like kale chips instead of potato chips there's a lot of differences in who decides to be a meditator we in terms of the health and biology we have found that there is slower biological aging and other people have found that um in these meditation interventions we do the short-term ones the inflammatory Pathways of gene expression are dampened way down and cross-sectionally other people like Elizabeth hoi have found

01:19:09 longer tiir in the meditators versus the controls um so we we haven't really found tiir lengthening in our short-term meditation studies but we do find boosts in tarase activity which is this enzyme that protects our cell aging slows our cell aging rilds the tiir so those are um those are those are studies that suggest if someone were to continue meditating they might keep up that slower rate of Aging so there's one study we did which I think was particularly um fun we went to a retreat center where deepo choer

01:19:48 leads this one we Transcendental Meditation Retreat so people got a mantra and they were um focusing for probably eight hours a day on different uh yoga meditation and reflective exercises and then we had half the group just walk around the resorts take walks hear some boring Health talks so that was our control group and what we found from that study was that in the short run run a week later everyone felt fantastic after the week right they weren't allowed to bring their laptop and work and they uh ate this great anti

01:20:25 inflammatory diet an ayurvedic diet and then the gene expression Pathways were like night and day from day one to the last day and our model of um machine learning model was able to identify people over 90% it could say whether they were on day one or day seven and the difference really emerged over the long run we went and we followed them about 10 months later

and we found that not everyone felt great 10 months later the group who learned meditation still had lower depression but the control group bounced right back up and then we

01:20:59 looked a little bit further and we saw that people with early adversity benefited the most from the meditation condition uh what was the meditation condition how long uh per day yeah it well so they did they learned transcendental Med sound primordial sound meditation which is similar to TM where you have a you're focused attention on your on a word over and over but there's also more awareness of the um the body and that was you know I I couldn't say how many minutes a day but it was on and off during the day okay so

01:21:35 repeatedly but for a fairly short period of time one week yeah right yeah I've never done one of these extended meditation Retreats are you interested well various people in my life have told me that I needed to go do a silent meditation but they probably were emphasizing the silent part the um uh still I recommend them I think they're amazing ways to get to the mind and to really calm the body in ways like a a you know a Quantum shift in our level of stress that we don't get it's very hard to get in short belts I do a daily

01:22:07 meditation practice but it's a relatively brief meditation practice I do tend to focus more on things like deliberate cold exposure and breath work and exercise and sunlight and all all the things I talk about in the podcast but I'm certainly not averse to uh doing a longer meditation are all of these um uh TM meditations are they silent meditations and they range from what two days to a week is that well the Retreats you can always find a retreat that's you know half a day one day a week two weeks

01:22:37 so you don't go right into a two we you work up to it so the longest I've ever done is a two week silent Meditation Retreat and that was after you know 10 years of doing yearly shorter Retreats and then when you you know I think it would be too hard and stressful if you haven't been able to I mean meditation can be stressful if it you know you think that you're failing at it and um so you need to have kind of developed the skill a little bit before you go on the the Retreats and so lots of classes

01:23:07 can do that in online but I think the short bouts every day are that is what is the most important message for people for managing daily stress and that's the in the stress prescription it's very much about how we can do short daily nudges to reduce our stress arousal so breathing is the one of the best body-based examples of getting right there but there are other ways so being in nature that's a really strong stimulus an environment that sends all sorts of safety signals to us yeah certainly it's not an either or but it

01:23:39 seems like nowadays A lot of the discussion that used to be had around meditation and its ability to evoke neuroplasticity and things of that sort has shifted over to um an increased focus on psychedelics a common theme on this podcast but it just seems like in you know taking the pulse of social media and the landscape out there there's so much excitement about psilocybin both in micro do and macro do and MDMA and some of the other trials that are out there that many people are starting to forget the incredibly rich

01:24:10 and vast literature supporting the use of even brief meditation practices for reshaping the mind so I'm glad that um we're talking about meditation but I mean even going into plant medicine experiences is enhanced if you have a little bit of training in how to in metacognition how to view the mind and thoughts you can observe the whole experience with that much more kind of calmness skill and wisdom knowing this is just the mind doing these cool things so it's not they're not separate and then I think the the psilocybin

01:24:42 experiences enhance daily meditation so they really go well together yeah and just as a little editorial on uh psychedelics um what's interesting I think about the clinical data is that um you know we think of the the Psychedelic Journey as the time in which all the changes occur because it has all these properties of hallucinations and altered thinking Etc that acts as kind of a gravitational pull around our our ideas about what psychedelics do but it's actually in the window after the Psychedelic Journey that the actual

01:25:13 rewiring of the brain takes place so when people talk about integration afterwards they're not just talking about the few hours where they're you know I'm parachuting back down to to uh uh typical consciousness let's call it that but that there's this long perhaps even weeks or monthl long tale of plasticity and that's actually when most of the rewiring is happening and which I find really interesting which is not unlike meditation where sure in one bout of meditation you might see a adjustment

01:25:39 or rewiring of the brain but at least from the book altered traits which I'm a big fan of um talked about these daily repeated short meditations or these longer TM Retreats as they're sometimes called um in inducing uh this big time brain plastic all right well now I'm going to have to do it and I'll report back to everybody what my experience was although I might do it silently um I'd love to talk a little bit about some of the other health metrics that you've explored not just in the context of mindfulness but

01:26:09 um I'm particularly intrigued by uh a graph here I'm showing my really nerdy side there's a graph in one of your papers it's the peard paper 2018 we will provide a link to to this in the show note captions if people want to take a look but it essentially describes the relationship between mitochondrial health and mood um in the context of people who have different type of

mood Tendencies if you um if you would be willing to just kind of describe the top Contour of that study and some of the the points that that you find most

01:26:39 interesting I think it's a fascinating study and and I I'm so glad you did it but I'll let you tell us about it yeah we've we've done these in-depth studies where we are looking at people under a lot of daily demand caregivers and then we look un look at you know normal people parents of neurotypical children who still have a lot of stress but we that we then ask you know does do people under chronic stress have accelerated aging so we look at tiir epigenetics mitochondrial health and then what

01:27:08 explains those who look really good who look resilient and don't look vulnerable and so then we can find out like what's the magic sauce in the day that protects them from chronic stress so Martin Bard my colleague who has been obsessed with mitochondrial Health as a pathway to understanding both stress and really health and disease he has developed a way to measure mitochondrial Health in humans so we can measure a bunch of enzymes and then we can adjust it for how many mitochondria we have so we have

01:27:39 this really nice index we can get from the blood and in this study of uh young mothers who were who had either typical children or children with autism we found that the caregiving moms had significantly lower or damped mitochondrial activity what that means is they can't produce as much energy so if they're feeling more exhausted from the chronic stress we know why I mean it's it really is a it was quite dramatic Martin commented some of those low levels even looked like people with some genetic reasons to have low

01:28:20 mitochondrial activity but here's the beauty of that study we then get to look with within their day at their mood and ask what about the caregivers who have really great mitochondrial enzymes and and thus should be making a lot of ATP they had more positive emotions both waking up and in the evening but especially in the evening and what's so interesting that is all of these daily diary studies of stress and mood one of the things we know that matters for long-term health is how positive you feel at night so especially

01:28:57 on a stressful day so at the end of a stressful day can you muster some feelings of content ease confidence Joy do you have any of that or has it just wiped out your positivity and so for people who feel either low lower negative or higher positive they tend to have better health trajectories so like a decade later less depression less heart disease less early death so what so that's why we care so much about daily moods and in in our study it looked like the daily mood was really quite correlated with the mitochondria

01:29:31 levels that same day then we measured mood like you know days away from that it was much less correlated so that it's just our first study on this but it really leads us to think that our mitochondria are sensitive to our thoughts and our feelings probably on a daily basis incredible so for those of us that find ourselves in a state of chronic stress um and here I'm talking about the kind of stress that you mentioned before which is you know there is unlikely to be a Simple Solution like we're just going to be

01:30:05 grappling with this thing um and you mentioned the words radical acceptance which I'd like to uh drill into a little bit too because this is a theme in the self-help literature and it's a theme in that now I think in the formal psychology literature I actually um was talking to a dialectical TR dialectical psychology expert recently I think that's the the correct title dialectical behavioral therapy correct yeah thank you that's common great one yeah you're you're correct I I was I was grasping and um that's correct and they

01:30:38 were um talking about um some of the misconceptions about radical acceptance because I think a lot of people hear the words radical acceptance at least is what they told me and think oh that means that you have to just accept what is and deal with it there's another form of radical acceptance which is I radically accept the fact that I'm not going to deal with this right I'm going to walk away from it but what you're talking about is chronic stress of the sort that really the stressor the fact

01:31:04 that a very close relative or family member is dealing with a lifelong condition or the fact that um we can't extract ourselves from a situation that we are not in full agency to remove the stress or that radical acceptance of that fact then can ratchet into an understanding of okay and yet there are tools that we can use to not just offset the negative health effects but maybe even thrive in the context of this essentially turning what initially was thought of as a curse into a blessing at least biologically

01:31:41 speaking what are the data around the practices that can help make that conversion possible I realize there's a lot of psychological work that needs to be done ongoing people need coping mechanism support groups always better to have more social support than less of course but are we again talking about a daily mindfulness practice or is it daily mindfulness of a certain type um what do we know about best practices for mitigating these essentially non-negotiable stressors it's a great question and

01:32:20 it's not a quick answer I think it is partly how we view life and our purpose in our own life what's this game that we know we were born into and even just the idea that bad things shouldn't happen sets us up for vulnerability to feel victimized to feel um like we can't you know accept bad things that have happened so just stepping back and asking everyone listening do

you have a situation in your life that is unwanted and you can't change it could be small it could be huge how much time do you spend thinking

01:33:05 about this the more we spend time trying to problem solve or worry or just wishing things were different the more we are creating a chronic stress State and so just even taking that first kind of step back to get perspective on what are the situations in my life that stress me out and and which of these can I Circle those that I can't change they're still they're on my list so they're they're on my mind they're still upsetting they haven't receded in the background they haven't gone away just that recognition of this isn't going to

01:33:46 go away is incredibly powerful because we can as I say put the baggage down and give ourselves some relief and some freedom from from the big space it holds in our mind and in our body and this is not a one-time thing it's a practice radical acceptance is something we practice over and over to help us loosen our grip on unwanted situations on letting them control our well-being and taking up you know this mental real estate that's so precious our attention so I would um there are statements that we can say

01:34:28 that help us and it's I have you know there are a few metaphors so I'm an expert at this because I have I'm a caregiver and I often need to refocus from wishing things were different trying to solve things to really um radical acceptance of this is how things are right now this is the reality and by just reminding ourselves that there is freedom within that that there are things that you can do you can actually live better live well with these situations so let me tell you what we've found from our caregivers we

01:35:12 measure where their mind is at night we we we ping them and we say in the last five minutes how much have you been wishing things were different how much have you been engaged and focused in what you're doing right right before we pinged you and just those two questions tell us so much about that person's well-being so people and actually yes the caregivers are doing more of what I'll call suffering wishing things were different not being present for their lives but regardless of that difference whether people are caregiver

01:35:48 or not this negative mind wandering state of not being present for your your evening wishing things were different instead of being engaged predicts more unhappiness it predicts shorter tares so it it suggests that it's a pattern that has gone on for days months and years that has been wearing on them and so some of the metaphors that I think are helpful for this are thinking of yourself think of this unwanted situation and think of how you're you're pulling a rope that's attached to a brick wall and you're doing that because you

01:36:32 care you want things to be better for yourself or this person and or a group I mean it's it's something you're passionate about and so you're pulling and pulling and every day you're pulling and and you can't move that brick wall so the only thing that's happening is that you're chafing your hands that tens that chronic tension what if you just drop the Rope I say that to myself drop the Rope when I start get you know getting going on trying to solve unsolvable problems the brick wall is still there it's never

01:37:08 going to move yet my hands are free and so I can be freed up to live in the ways that I do have control over to do things that help around the edges so I was just talking with someone who is just so concerned about about their aging parents and you know them not getting the care they need not taking care of themselves you know things aren't going well but there was so little that they could do to help their parents and so by dropping the Rope for them meant realizing there were things they could

01:37:41 do being present being loving uh doing the little bit of care that they could from a distance was all they could do and that's enough that's that loving presence is like a gift that we don't realize that we we always have that to give where do you think the tendency for us to try and pull on brick walls comes from I mean it's so non-adaptive um and I've also heard it St that uh people do this in the reverse Direction too meaning in time trying to control the past through current behaviors as well as trying and control

01:38:19 the future um it's kind of so give me an example of that yeah this is something I learned from a guest we had on here Dr Paul kti's a psychiatrist Who U extremely skilled psychiatrist who wrote a book on trauma which I think is the best book on trauma frankly um and he talked about how the lyic system that engages these fight ORF flight responses has no sense of time and that's why developmental scripts get reactivated in particular parent child or caretaker child uh neural circuits that were engaged in those relationships when we

01:38:54 were really young get reactivated in adult relationships I mean in some sense it doesn't make any sense like why would the human mind have separate circuits for adult like romantic attachment versus child parent attachment this all sounding very Freudian And yet when you look at the the Neuro Imaging it's like you get one set of circuits for understanding of relationship of course you adjust according to context and they get repurposed you don't just set that aside say that was for childhood what he

01:39:18 said was that the lyic system and the stress system when activated um distorts our perception of time and that um this is what he was uh saying leads to the what's sometimes called the repetition compulsion people try and will repeat the same uh Place themselves into mildly to severely traumatic circumstances over and over again despite the presence of a of a trauma

doesn't have to be childhood trauma you think well that doesn't make any sense is like the most illogical thing in the world like you get burned

01:39:50 on the stove and you keep going back to the stove and the idea is that these circuits when they get activated really engage entire like cognitive scripts that make it very hard to escape it's like it pulls you into a story that is exquisitely hard to to to get away from and so that this repetition compulsion is an attempt to try and rewrite the story and this is this is the theory not just of Freudian psychology but kind of modern trauma and Neuroscience informed trauma Therapies in any event as you describe the this pulling

01:40:21 on a brick wall I find a very compelling image um and one that uh makes total sense to try and drop the Rope as you describe it because of the incredibly High energetic demand that pulling on that rope represents as you said it's sort of a way of diverting resources toward something that has no conclusion right and in dropping the Rope you can divert those resources toward other things um so I was just curious again I wasn't consulted the design phase and I'm assuming you weren't either but you know

01:40:52 I wonder what in us uh as scientists I'm just kind of doing the gunkan experiment here like I wonder what in US as human beings compels us to um try and change what we the unchangeable we really really really love control and we want to control the future not just because it makes us feel powerful and happy but because then we can relax if we know what's going to happen next if it's predictable we're that much happier we're not Vigilant and looking ahead and being prepared for what might happen so

01:41:34 let me ask you that so I have two whole chapters in the stress prescription one is on uncertainty and one is on control and these drive us crazy until we can somewhat master and understand how little control we have and how much uncertainty there is and will always be so let me ask you this if you couldn't plan your day tomorrow and you wanted to know with certainty what your plans were what was going to happen how much ease and relaxation would you feel at the not knowing what's going to happen tomorrow

01:42:13 very little so like on a 1 through 10 scale how much would that drive you crazy tomorrow tomorrow Saturday so I'm a little more flexible Monday oh no Mondays I Mondays are mine I own Monday no I'm kidding I'm just kidding I love Mondays it's always been my favorite day of the week um uh even when I was in school uh yeah that would be on that would be a six yeah six out of 10 and that's not unusual and we have a scale to measure how comfortable people are with certainty and what we already knew was

01:42:49 that being comfortable with uncertainty is a beautiful but rare resilience Factor people who tolerate uncertainty have much less anxiety and depression and when stressful things happen they get over it more quickly so we measured this during the pandemic and what we found was that intolerance of uncertainty pretty strongly predicted pandemic anxiety PTSD depression and distress about the fires the climate the climate situation in California so this is interesting I mean is this like a fixed personality and we're

01:43:26 just stuck with our rigidity around wanting certainty or is this something that we like a muscle that we can build so I think it's a ladder and I think there are practices we can do that help us feel ease with the uncertain future some of these mindful check-ins noticing that we are carrying around uncertainty stress is one way and then reframing uncertainty as the beauty of the mystery of life and the freedom that we can feel when we realize we don't control tomorrow we just go with it and we know we do

01:44:09 our best and what Delight there is in just viewing things with curiosity and just seeing what emerges so even just our posture here's an exercise for dealing with uncertainty instead of like kind of that alert posture when we're like trying to take it all in and predict the next Second and like just lean back and take some slow breaths we know that's going to help Orient us and realize that we can actually face time in that way by letting it come to us and receiving what happens and that's a completely

01:44:47 different body stance than our usual go mode during the day and that's just a way of saying I am in a you know receptive mode and I'm going to just be curious about what arises and so I actually learned that on a Meditation Retreat because I tend to be type A and I leave a retreat going from like very relaxed to like that leaning forward tense of like where's the to-do list and so carrying with me that posture of like just see let time unfold as it will without try to control things it's really interesting it gets

01:45:26 right to the heart of something that I spent a lot of time thinking about in the context of Stress Management and also just general thriving which is that I think that um about half of the messages that we get related to stress and Mind Body interventions relate to adopting this forward Center of mass um you know this idea of okay stress can give us early dementia stress can limit our sleep stress can impair our cognition or stress can make us more resilient stress can activate all sorts of positive anti-inflammatory Pathways

01:46:03 as well that the mindset matters and here I'm I'm doing a terrible job of it but I'm trying to scrape off and um capture the top uh Contour of the beautiful work of my colleague uh Dr Aaliyah Crum who's you know love her work been on this podcast and is I'm a huge fan of her work as well and um that mindset matters because it sh ap's physiology for sure it uh her data point to

that so there there're these kind of forward Center of mass type uh approaches um and these are abundant on social media um you know different

01:46:37 people come to mind um different archetypes really have emerged you know millions and millions of followers that are the archetypes of when challenge arises you smash into it you go through it right um and then on the other hand there are these stress ation techniques both mental and physical body oriented mind oriented Etc that are more of the sort that you described that are um they're not um being back on your heels so to speak like letting things bulldoze you but are more of this uh receptive

01:47:09 mode and a more of an awareness mode exactly and I think that um since here we are at the table to researchers who uh focus on these issues a lot do you think it's fair for us to adopt a sort of a general framework and model that that perhaps people can adopt for themselves if they like that of course it's not an either or but that having both of these in one's kit of tools could be valuable um because one is less energetically demanding but of course offers less opportunity for agency um at least apparently so that's

01:47:44 the leaning back and then the the other is um certainly gives an opportunity for agency but we know from 100 years or more of psychology and psychiat atric literature and from the emerging literature on stress mitigation that it's work it's not something that is without a cost it can get you far better results than it were you to just let stress bulldoze you but that it's work and so we have to emphasize that work um in very deliberate ways exactly I couldn't agree more it's work when we know it's productive we should work and

01:48:21 when we know there's a brick wall we should let go so I think of it I like this forward Mass idea I think of it as you muscle it and or you release it and we need both and so that letting go is a really important wise you know Discerning way to mitigate stress in the right situations and the right time and you know we can't muscle through everything right so another way I like to think about it is just the waves of life like I mean we are in an ocean and we have small waves we have big waves some of these tidal waves are going to

01:48:55 hit all of us the global stressors the the climate disasters that will come and so when we're not in the middle of a wave which is when we need to muscle it we're between waves how much control do we have to fight the tide there some it's not black or white we we are we we can't fight a rip tide we need to go the direction of the tide but we can have some control on our Direction and it kind of goes back to um our colleague Robert spolsky's very biologically based idea of us having you know he's a little

01:49:34 bit extreme with a no free will we are we are influenced by all of these things around us as well as all of our biological you know I'll say um brilliant evolutionary animal instincts so given all of that we have have some deterministic forces on us and within that we get to ease up between the waves when we can we get to change our Direction but we're always going to be hit by the next wave and so it's this skillful surfing or navigating that we can do better when we realize when we control things when we can't when we can

01:50:19 truly feel safe and have ease versus when we need to kind of gently padle what do you think is the value of of journaling and and placing one's own narrative on stressful circumstances especially these non-negotiable circumstances again I'm I'm fascinated by these because I think it's a category of stress that's not often talked about and yet is so prominent so people will say okay you know dealing with short-term stress okay well well I would say like use physiological size or raise your stress threshold and we'll get back

01:50:49 to that in a little bit um as it relates to the work you're doing with breath work but so many stressors are going to take a year five years we don't know you know that the uncertainty that you mentioned earlier or the the certainty that this is going to go on forever and so you know what is the um you know for people that are listening to this and that and want to start to adopt practices um do you think that spending some time creating a written or a spoken narrative is helpful we hear this but

01:51:24 are there any data that support the use of journaling as a as a tool I seem to recall that there there are a few studies out there but I can't I can't remember exactly yeah definitely creating a coherent n narrative is critical to our ability to make sense Find meaning find resolution have a social identity around our lived experience what happens to us so narrative is kind of everything right in stress research it's it's not what happens to us it's how we're interpreting it and how we're um how

01:51:56 we're responding to it and I've I've heard you say the exact same thing when you've talked about what is stress it's it's really what narrative we're creating around it so I think a narrative of purpose fill in the blank about what you're what's meaningful to you but that is why we're different than just the the um the rats that we study or the monkeys like they have these amazing stress responses that are we have them too and we can't control that but we have the ability to do this projection to the Future to ask what is

01:52:30 our purpose in life to see and know that we are going to die and we can have some control over how we live and maybe even how we die and how we want to be remembered that is so beautiful that helps us Rise Above This being monkeys and clothes I'd love before we wrap for us to return to this uh question about breath work and the study that you're doing one of the I've known

about your work for a very long time admired it for a very long time and one of the things that um excited me about being able to sit down with you

01:53:04 today is that uh our laboratory has studied breath work your laboratory is studying breath work and um and I know that you've been doing a study on the so-called Wim Hoff method um which I'll let you familiarize our listeners to some of them are familiar with the Wim Hoff method others are not I think a lot of people think of him in terms of his is the ican because of cold exposure but of course he has um breath work practices that mirror um things like Tumo breathing and other things but U maybe you could tell us a little bit

01:53:33 about what you're doing there and U what you're interested in discovering I realize it's too early to give us the results but um hopefully they'll come back and do that at another time but what is the study uh what motivated the study and and maybe I can convince you to give us a little teaser of what you're discovering so for I I for many years I mean I think my um first paper when I was a graduate student with Bruce mckuin was about this idea of positive physiological stress and so I've always

01:54:03 been wanting to really understand what's positive stress how can we induce it and instead for many many too many years I've been studying the dark side toxic stress trauma caregiving and how that is can take a toll on the body without the right resilience and resources and now I'm very excited about the the opportunity to just focus on different ways that we can stress out our body and mind in short-term bursts that might promote stress resilience and the body based strategies are concrete they're quick they're um they're also my

01:54:48 favorite strategies I I probably have internalized a lot of the mindsets and the you know the that I've learned from meditation and what I feel the biggest bang for the buck is you know if I'm um waking up like super jittery with a big stress response because of X or Y it is actually something like a a hit type workout or taking the dogs for like a really brisk walk or like burning up that energy in my body is um a very big effect size for me personally everyone has their you know different ways that

01:55:21 they can see the the biggest shifts in Daily stress so I've been looking for ways to create positive stress besides exercise we all know about exercise and I met whm Hoff at a uh a meeting where we talked kind of back to back and so we hadn't I had kind of heard something about you know crazy Iceman climbing up the Himalayas I really had he has 27 or more World Records yeah for that sort of thing yeah so he so I got to hear I got to do the breathing with him during this conference and I just felt like Elation

01:55:58 afterward I was like what was that and then he heard about tiir and he was like I need to know if my method is affecting cell aging he loves research and so we he helped us design a study that we've been working on at UCSF um with my colleagues Wendy Mendes and Eric prayther it's been many years and it's funded by the John W brick Foundation which is very focused on what are non-drug way ways that we can help mental health so it was a very good fit for all of us to come together design the study and we have been basically

01:56:33 comparing low arousal relaxation methods mindfulness slow breathing to positive stress exercise and whim Hoff method and one of the things that we've learned in a big way is that regardless of whether we're creating deep states of ease or hormetic stress in the body that short-term burst of either aerobic activity or the extreme breathing people feel better period so three weeks later after this experiment of doing their practice every day they were either randomly assigned to the higher rle or

01:57:08 the low rle the level of stress anxiety and depression fell dramatically in everyone so many paths to changes in stress there are probably very different physiological paths ways and and we can talk about that more when we um get to really look in depth at our physiological data as well as our blood-based data but what we do know is that the Wim Hoff method did create daily positive emotion that increased over time just like your study on sighing and so even though there are different mechanisms they were

01:57:47 selectively boosting feelings of positivity I love that you know that's very unusual to get a very selective positive effect super interesting I can't wait to hear more about the data so I I gather and by the way no is a perfectly fine answer I gather that you're not going to tell us about the whether or not there are tiir changes yet or maybe that's not possible um to detect in this kind of short-term study so what we're going to look at we don't really think that ters can change very quickly and and tase May so we're going

01:58:24 to look at mitochondrial enzymes tase and gene expression patterns and as you know we can look at many different mechanisms and Pathways with gene expression patterns especially with these new kind of assays where you can look at you know 7,000 different uh proteins like the somalogic and so we'll get to see well what's the patter you know did we really change patterns of acute stress with these different types of stress resilience intervention and in terms of the physiological reactivity there are ways that we

01:59:00 can examine both the stress response system parasympathetic nervous system and the sympathetic response system and I will tell you that um while we're still preparing the results there were very different profiles from the different interventions that make us think that there's a lot of specificity even though everyone feels better the the way that they got

there is very different ways that we're impacting both the nervous system and the Brain incredible and um I have to say when I heard that you were studying whim

01:59:33 Hoff method I was positively uh delighted because I uh I find that there are so few serious researchers in the realm of of modern science that are both explorers and then take what they've um you know glean from those Explorations and then take it to the laboratory and and put rigor on those and really try and parse mechanism with with of course all the open-mindedness to whatever the outcome happens to be right I mean good science involves um not necessarily asking questions alone but um raising

02:00:08 hypotheses and being comfortable for those hypoth hypotheses to be correct or not correct and I find your work to be just so incredibly creative and brave in that way and I love the way that you've meshed different aspects of your own personal um journey into these different practices I don't know what came first the science of the practices but I I I have uh I have my guesses but um I must say it's it's very refreshing and I think it's exactly exactly what the world needs right now in terms of tools

02:00:39 for mental health and physical health because um far too many studies uh try and isolate variables without understanding a larger context of like what are the different types of stressors and clearly you're addressing that or you know there's this thing breath work that some people might think oh you know the Iceman whm Hoff it's really esoteric and you know kind of crazy um I'm certainly not saying that but that you say well what are the critical elements from that that we might be able to extract to understand

02:01:04 this positive ESS phenomenon so I just um for I want to first of all just say thank you for doing the incredibly important work you do and thank you I mean we were so delighted to um see the paper you did with David Spiegel and to know that you're pursuing this path and um it's very reassuring with your rigor and your you know depth of background I I agree with you this these are the types of studies we need releasing the inherent power of Rejuvenation that's in our body is UNT it's relatively untapped

02:01:39 in these rigorous controlled studies and we just can't reduce inflammation with a drug we can't reduce stress with a drug we desperately need to learn how to use you know the whole range of the nervous system from the acute stress to the deep relaxation to heal and to promote these healthy resilient States I couldn't agree more and um UCSF is uh very very fortunate to have you and should they ever forget that please come to Stanford instead maybe we can recruit you away from UCSF and I'm here I'm U being

02:02:11 friendly to my colleagues at UCSF but um they better treat you right or else we're coming for you uh and I also just want to thank you for taking the time today to share this information also you've written one F books we will provide a link to the newest one and I'll um of course cue people to that because it sounds like a very rich source of information and actionable tools that people can take in terms of mitigating stress and I I love the idea that there's this um discussion about certainty and control uh to elements

02:02:40 that are very prominent in in my life um for better for worse and all of us all of us yeah and so really thank you for the work you're doing thank you for taking the time to share that work through books and through podcasts and especially today on this one I I know I speak on behalf of many many people and I just really want to extend my gratitude thank you so much and thank you for for your podcast well it's a labor of love and it's days like today and discussions like this that make it worthwhile so thank you thanks Andrew

02:03:11 thank you for joining me for today's discussion all about stress aging and Metabolism with Dr Alyssa eel I hope you enjoyed the conversation as much as I did if you'd like to learn more about Dr eel's Laboratories work or if you'd like to learn about her books such as the te miror effect and the stress prescription please see the links in the show note captions if you're learning from and or enjoying this podcast please subscribe to our YouTube channel that's a terrific zero cost way to support us in addition

02:03:37 please subscribe to the podcast on Spotify and apple and in addition on both Spotify and apple you can leave us up to a fstar review if you have questions for me or topics you'd like me to cover on the hubman Lab podcast or guests that you'd like me to consider inviting on the hubman Lab podcast please put that in the comments on YouTube I do read all the comments in addition please check out the sponsors mentioned the beginning and throughout today's episode that's the best way to support this podcast not so much on

02:04:03 today's episode but on various previous episodes of The hubman Lab podcast we discuss supplements while supplements aren't necessary for everybody many people derive tremendous benefit from them for things like enhancing sleep focus and hormone support the huberman Lab podcast is proud to have partnered with momentous supplements if you'd like to hear more about the supplements discussed on the hubman Lab podcast please go to Liv momentus spelled o us.com huberman again that's liv.com huberman if you're not already following

02:04:30 the hubman Lab podcast on social media we are huberman lab on Instagram Twitter Facebook and LinkedIn and on all those places I focus on material that somewhat overlaps with content from the huberman Lab podcast but often is distinct from the content covered on the

hubman Lab podcast so again it's huberman lab on all social media channels for those of you that haven't already subscribed to our so-call neural network newsletter this is a completely zero cost monthly newsletter that has summaries of podcast

02:04:57 episodes and so-called toolkits toolkits are lists of about a page to two pages long that give the critical tools for instance for optimizing sleep or for neuroplasticity or deliberate cold exposure deliberate heat exposure optimizing dopamine again all available to you at zero cost you simply go to hubman lab.com go to the menu tab in the corner scroll down to newsletter you provide us your email we do not share your email with anybody and in addition to that there are samples of toolkits on the hubin lab.com website again under

02:05:27 newsletter and you don't even have to sign up to access those but I think most people do end up signing up for the newsletter because it's rich with useful information and again completely zero cost thank you again for joining me for today's discussion with Dr Alyssa eel all about stress aging and metabolism and last but certainly not least thank you for your interest in science [Music]

00:00:00 welcome to the huberman Lab podcast where we discuss science and science-based tools for everyday [Music] life I'm Andrew huberman and I'm a professor of neurobiology and Ophthalmology at Stanford school of medicine today my guest is Tim Ferris Tim Ferris is an author a podcaster an investor and is known for having a near Supernatural ability to predict the future which has allowed him to obtain success in a huge number of different Endeavors for instance he is a five-time number one New York Times bestselling

00:00:33 author but perhaps equally or more important to that he's also exceptionally good at teaching people how to write the entire process of writing and marketing a book his books the 4-Hour chef and the 4-Hour Body and the 4-Hour Work Week not only explain his own exploration of how to optimize and prioritize his time and learn particular skills but he teaches you those skills as well this is really what sets Tim apart he is an exceptional learner and an exceptional teacher and today you learn why that is and in a

00:01:05 characteristic Tim Ferris way he explains the process in a way that you can apply it he lists out for instance the specific questions that you should ask When approaching any Endeavor in order to get the information that you want and to make the process of learning and getting better at something and achieving great success in something that much more likely that ability that Tim has to identify the specific questions that one needs to ask and answer answer and the specific action steps to take in order to achieve

00:01:33 success is really what I believe sets Tim apart from everyone else on the Internet or on the bookshelf that's giving advice as to how to become good at something Tim Ferris is also dedicated to various philanthropic efforts the most recent of which is the donation of several millions of his own dollars to research on psychedelics for the treatment of otherwise intractable psychiatric challenges such as major depression suicidal depression eating disorders and addiction and he's also brought together other philanthropists

00:02:04 which has really galvanized the whole field of psychedelic research for the treatment of mental health transforming it from what was recently kind of a fringe area of science to a main stay that's actually funded not only by philanthropy but by the National Institutes of Health so he's really transformed this entire scientific field into one that now is transforming the laws around psychedelics and is providing mental health treatment for people that would otherwise suffer today's discussion was a particularly

00:02:31 meaningful one because not only is Tim a Pioneer in the world of podcasting but it also marked the 9-year anniversary of his podcast the Tim ferah show now as I mentioned earlier Tim is known for being able to see around corners or predict the future he really does seem to be about five if not 10 years ahead of everybody else in thinking about tools for optimization in

particular domains of life and so we were very fortunate that during today's discussion he shares with us his current creative Endeavors

00:03:02 and how he's thinking about and approaching those and he also breaks down for us the process of how to think about and prioritize one's schedule not just on the order of the day not just on the order of the week but really thinking about one's life as a journey and how to organize and go about that Journey so today's discussion will provide with you tremendous insight into who Tim Ferris is and how that incredible mind of his Works in order to do all the amazing things that he's done and of course he teaches you how to do

00:03:33 it he will tell you the exact questions that you should ask and that you should answer and how to step back and think about those questions and then prioritize so that you can decide how to best invest your time I'm sure many of you are familiar with the Tim ferah show however if you're not already subscribing to the Tim ferah show I highly recommend you do I still go back and listen to early episodes of the timf far show and I'm a weekly listener to the new episodes we provide a link to the Tim Fair show in the show note

00:04:00 captions also in the show note captions you'll find links to Tim's many New York Times best-selling books and a link to his excellent weekly blog before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford it is however part of my desire and effort to bring zero cost to Consumer information about science and science related tools to the general public in keeping with that theme I'd like to thank the sponsors of today's podcast our first sponsor is

00:04:25 Maui Nei venison Maui Nei venison is the most nutrient-dense and delicious red meat available I've talked before on this podcast about the key importance of striving to get 1 gram of protein per pound of body weight now when one strives to do that it's also important to maximize the quality protein to calorie ratio in other words you don't want to consume a lot of extra calories in order to get your quality protein Maui venison in having an extremely high quality protein and nutrient to calorie

00:04:54 ratio allows you to do that very easily and in addition to that Maui Nei venison is delicious I particular like their bone broth which has an unmatched 25 gram of protein per 100 calories I also love their ground venison and their venison steaks all of them are absolutely delicious if you'd like to try Maui neui venison go to mauii Venison docomo and get 20% off your first order again that's Maui venison docomond to get 20% off today's episode is also brought To Us by element element is an electrolyte drink that has everything

00:05:26 you need that is the electrolytes sodium magnesium and potassium but nothing you don't which means no sugar it's critical that we get electrolytes because every cell of our body but in particular our nerve cells our neurons rely on electrolytes in order to function properly with element it's very easy to ingest the correct ratios of electrolytes they come in these little packets they're really delicious you mix them up with anywhere from 8 to 16 to 32 ounces of fluid I like mine pretty concentrated so I'll drink a 16 o glass

00:05:55 of water with element in it when I first wake up I'll also consume another one of those maybe 32 ounces with one packet when I exercise and maybe another one if I happen to sweat a lot during exercise or if I was in the sauna and sweating lot if it's a very hot day Etc if you'd like to try element go to drink element that's lnt.com huberman to claim a free element sample pack with your purchase again that's drink element lnt.com huberman today's episode is also brought To Us by levels levels is a program that

00:06:24 lets you see how different foods and activities impact your blood glucose levels or blood sugar levels as they sometimes referred to with levels you can see how the specific foods you eat when you eat and exercise as well as any other activities impact your blood glucose and how those affect things like your energy level or your quality of sleep or your level of clarity and focus for mental work or your physical output for physical Endeavors I first started using levels about a year ago as a way

00:06:52 to understand how different foods and activities impact my blood glucose levels and it's really impacted my entire schedule in fact I've shuffled a number of things around such that now I have more stable energy throughout the day yes I eliminated one or two Foods fortunately they weren't my favorite foods I've also added some new foods to my nutrition program that have allowed my blood sugar levels to remain much more steady throughout the day and to achieve better sleep at night levels even provides a simple score after any

00:07:18 meal you eat so you can see how different foods affect you and develop a personalized nutrition program that's exactly right for you and that's really what levels is about it's really about tailoring things to your specific needs so if you're interested in learning more about levels and trying a CGM yourself go to levels. lhuin right now they're offering an additional two free months of membership again that's levels. linkhub and now for my discussion with Tim Ferris Tim Ferris I am nothing short of thrilled to

00:07:48 have you here I've been reading your books reading your blogs listening to your podcast for a very long time and in preparing for today I was thinking you know who does Tim remind me of because I knew you reminded me of somebody but I didn't know who and then I realized it you remind me of the neurobiologist Ramon kahal you don't look anything like him he

doesn't look anything like you uh he was a brilliant scientist he won the Nobel Prize in 1906 for essentially describing the structure of the nervous

00:08:22 system he was the first along with another guy to Define synapses like it's fundamental connection the nervous system but the reason that you remind me of kahal is that it's a well-known or not so secret secret in Neuroscience that if you want to pick a really excellent project to work on you simply go and look at what kahal talked about or hypothesized and then you work on that you know he had this almost um super natural ability to look at fixed stained tissue of the nervous system much of it

00:08:59 is incredibly beautiful by the way and think about how it worked when it was alive and he's considered the greatest neurobiologist of all time without question and it's really this feature of being able to like see around corners or into the future that establishes that link for me it's it's absolute truth that if you look back to what you were doing 10 years ago 15 years ago the kinds of things you were doing the kinds of questions you were asking that translates to much of what people like myself and people in the

00:09:32 fitness space Tech space investor space mindfulness space psychedelic space all these different Arenas what they're doing now so um it's not hyperbole to say that you are the remon Cal of all those different spaces and podcasting of course is one of those so I owe you a great debt of gratitude and many others do as well so my first question for you is what was your mindset around the time that you wrote 4our Body 4our Work week but in particular 4-Hour Body because the protocols in that book are so very useful they were

00:10:12 at the time it was published they still are now and so many of the things like ice baths the discussion around Brown fat thermogenesis um resistance training in its uh you know kind of basic form of just providing enough Progressive overload to get an adaptation not excessively long workouts weight loss slow carb diet um and on and on and on what were you thinking at that time like what if you can think back to then like what what were you foraging for what were you thinking about when you woke up

00:10:44 in the morning think oh I'm going to go find all this stuff that at the time was really esoteric because it is all played out very well um what I'm basically saying is if you want to know what's going to be happening hot and useful in 5 years 10 years and onwards just look at what Tim's doing at any moment so there it is well thank you for the very generous comparison and intro I'm thrilled to be here so thanks for having me and the 4 our body represented an opportunity for me to do a few things

00:11:15 the first was to diversify my identity from outside of the realm of the say business category so it was a deliberate move since the success of the first book book bought me permission to do something else that Publishers would still want to gamble on I wanted to see if I could maybe like a Michael Lewis take my audience with me to other topics so that was a lateral move that was very deliberate from a career optionality standpoint and then I was doing I think what I've done for a very long time and what I enjoy doing

00:11:46 which is looking at the most prevalent beliefs and maybe dogmatic assumptions in a given field could be anything if anyone says always never should I pay attention and take note of that they may very well be right but if anything is said in absolutes I like to stress test and in the case of say physical performance or physical manipulation tracking 2008 2009 was a very interesting time because a number of different Technologies were coming online meaning being adopted by small groups you had the very early stages of

00:12:27 say accelerometers as variables you had a number of different Innovations and means of tracking that had never been available before you had for instance and this took a bit of fiiing on my side it wasn't immediately on the road map for the 4our body but continuous glucose monitors at the time that was I want to say exclusively limited to type 1 diabetics or maybe type two diabetics but largely type 1 diabetics and what captured my interest and I can't recall how I came across it but it was probably

00:13:01 through the very earliest iterations of what later became the Quantified Self movement and I remember attending the very first gathering at Kevin Kelly's house in Pacifica California this is this was around 2009 12 people 13 people to discuss quantifying Health but the the example of a professional race car driver I can't remember the the form factor whether it was F1 or Nascar or other who who was using this continual glucose monitor for paying attention to glucose levels while driving and I thought to myself would

00:13:40 that not be useful for healthy normals would that not have other applications if this if this is being used by high performer in this type of context might it have other types of applications which then led me to use the very early versions of Dexcom which were really painful to implant no longer the case of course that's changed a lot and I wanted to see how I might be able to find a handful of different categories of things there's the new like the genuinely new like CGM at that point was genuinely new the very

00:14:15 old that might have some room for scientific investigation and I would say when I say scientific I don't necessarily mean randomized control trials at a university I do think as an N of one if you think about study design and you can even blind you could even Placebo control and I knew people in the small subculture of Quantified Self who did this you can I think approach things in a

methodical way where you can make a lot of progress in trying to determine causality or lack thereof looking at very old things looking at orphaned

00:14:51 things so for instance there are many examples in the world of doping where you have say Bal back in the day where famously Barry Bonds and others purportedly use things like the cream and the clear and these were based on anabolics that were sourced from Soviet literature or older literature from the 50s and 60s that might not be on the radar of say the anti-doping uh groups that would administer the testing so all of these different buckets were of interest to me and I begin where I usually do which is

00:15:28 interviewing folks so I would interview one or two people in a given field and I might ask them any number of questions so one is what are the Nerds doing on the weekends or at night this is also really good for investing it's like all right what are the really technical nerds doing at night or on the weekends after they've put in a really long work day or work week let's take a really close look at that another one is and I'll I'll create a flow for this but what are rich people doing now that everyone or tens or hundreds of

00:16:03 millions of people might be doing 10 years from now and an example of that would be let's just say full-time assistant virtual assistant AI right so we've seen the needs and wants being addressed by different technology but it's an iteration of the same thing on some level in the case of say using chat GPT tied into zapier for various functions and then where are people cobbling together awkward Solutions so where are people piecing together awkward Solutions and is there room for some type of innovation there these are a few

00:16:39 of the questions that I would not only ask myself but ask experts in different areas so if I end up spending time say this was a few years prior to writing the 4-Hour Body I spent time at Nasa as and was interacting with a number of scientists some people who were working on all sorts of biological tests and at genomics and had a very Frank discussion about where they thought if they had to push right so I'll ask questions like push a little bit into the realm of Science Fiction and speculation because

00:17:11 I'm sure you can't support any type of projection like that with the literature with scientific literature but what do you think some of the risks are of say publishing your genome because at the time a number of high-profile folks had just made their full genomes available they're like well I think in the near future it' be possible to reconstruct someone's face based on their genetic data and they like high degree of confidence like zero 100% how confident yeah 80 90% I'm like okay I should pay attention to that because if

00:17:42 you're making your data available let's just say and it's anonymized per se you still might be identifiable it's like okay that raises some interesting questions like okay well then how might you get around that how might you put in safeguards so that you are the one and only keeper of your data so to speak uh brought up all sorts of targeted Weaponry uh bi sort of bioweapons possibilities that I was interested in and then I would ask that person who's clearly like willing to step outside of the box of whatever he's working on

00:18:13 dayto day who are two of your close friends or two thinkers you really pay a lot of attention to are kind of at the bleeding edge of something and unorthodox and then I would just continue to have these conversations over and over again and the the dream of development that I paid a lot of attention to is something along the lines of the following so the the very Beginnings are usually in some type of extreme case and I think the extremes and this goes for product design as well but the extremes inform

00:18:45 the mean but not vice versa so you can actually learn a lot by studying the edge cases so race horses for instance uh you'll often see things start with say race horses uh or people with wasting diseases for instance or any type of chronic or terminal illness who are willing to try some more experimental interventions then let's just take one step further bodybuilding see a lot of interesting behavior in bodybuilding and high level athletes then billionaires then rich people then the rest of us

00:19:16 right so my assumption is and was for the for our body that along the lines of William Gibson's quote you know the future is already here it's just not evenly distributed so I'm never predicting the future I'm just finding the seeds that are germinating that I think are going to bloom and end up spreading really really widely uh so that's that's that's generally where I start and I assume the practitioners are going to be ahead of the papers so studying say the coaches whose jobs are on the line who are getting paid based

00:19:47 on Athlete Performance and assuming that a lot of that will eventually if it holds up make its way into say the peer-reviewed exercise science papers but it's going to have a lag time of three to five years at least at least at least takes a long time yeah science is often very slow to catch up yeah um you mentioned many things I have questions about um you mentioned paying attention to the new the very old or the orphaned um so interesting and I just thought I'd uh tell you that when you sit down with a graduate student or a

00:20:21 postdoc and they're trying to come up with a project rarely do you say you know like what do you want to work on and they fire back like really interesting question sometimes they do but that's the rare person more often than not you'll send them to the literature and they'll come back with like okay there's this new technique that we can use to answer a set of questions better

than ever before or there's a very old Theory I want to revisit or there's this theory that no one pays attention to in fact we had one

00:20:50 guest on here ODed Ravi who is studying it essentially um inheritance of traits transgenerational inheritance of traits it's a little bit although different from Lamar uh uh Evolution but it's a lot like that um in some ways and you know these orphan theories that everyone assumed were wrong and there is a basis for them so I think there's Real Genius in that U analysis um it also struck me as you were um listing off some of your process Circa the the writing of the 4-Hour Body that I and many other people are are

00:21:23 probably curious about what the operations around all that looked like so are you or were you at the time like waking up in the morning going okay I'm going to take a walk and think about the new the old and the orphaned or um I'm GNA take a walk or sit in a chair and think about like what are the Nerds doing right now what are rich people doing right now cobbling together awkward Solutions was was that exploration a structured practice for you or is this just something that um was the consequence of being Tim Ferris

00:21:54 waking up in the morning and just like leaning into that because i' I've experienced both right you know but I think a lot of us are uh Curious I mean that there's a lot of Mystique around you um my best to dispell it whether whether you like it or not um it it's there and um and we're not trying to to pry but pry away is the is the establishment of structure for you something that's the consequence of structure in the first place it's like okay now it's time to think or do you just allow things to geyser up to the

00:22:28 surface I do both and I would say that in the case of the 4-Hour Body it's it's a bit of an anomaly compared to my later books because I had recorded effectively every work ad I had done since age 16 as a competitive athlete I just I had a lot of records and I kept copious notes on supplement use and everything imaginable so I have what you might call hypergraphia I just capture almost everything in writing and that was very useful because various points in time let's just say I looked at a photograph

00:23:01 of myself from making this up but 2004 and I think I would like to look and feel like that again okay let me revisit my workout logs let me just replicate the preceding three to six months of workouts and look at my intake and my diet at the time and lo and behold more or less I could replicate the same type of look and feel and performance so I had a lot already logged that I thought was worth examining and putting up under scrutiny trying to replicate with other people I do think replication is really

00:23:33 important and then when it came time to commit to writing the book I thought about what types of mini books would be of great interest to me personally and that book like many of my other books was written in such a fashion that it could be a Choose Your Own Adventure book did not need to be read in fact in many ways it shouldn't be read linearly from page one to the end you get to pick and choose which chapter chapters are of Interest based on breath hold vertical jump endurance hypertrophy cold exposure for fat loss

00:24:06 whatever it might be and then I began talking to people and at the very outer bounds of self-experimentation at least in the Bay Area it's a pretty small community so you're one or two lily pads from just about everyone and it's not accidental that I put myself in that environment in San Francisco specifically and more generally in the Bay Area Silicon Valley because there's just a high surface area for luck to stick to because you have so many serendipitous encounters you have so many people focusing on different

00:24:42 disciplines that I think was the fertilizer and the fertile ground for everything else was actually the choosing the wear of writing physically being located in San Francisco and then when I'm structuring things maybe I'll get into some of the nitty-gritty but I was using at the time and I still like to use a program called scrivener which is actually designed predominantly for screenwriting it's used for many things now novels and so on it's expanded its reached quite a bit but it allows you to

00:25:15 gather research and all of your documents and drafts so that you can move them around in very novel ways so you can view say a split pane of your research and what you're working on simultaneously without having to toggle between a lot of different windows and I was very promiscuous in my gathering of data so I would gather from say the web using a Web Clipper from Evernote which I was involved with as a company and basically without bias capture as much as possible put three asterisks next to anything that I

00:25:49 thought I really might want to revisit after I had read something a second time which I would always do then I could control F to find just three asterisks because they don't occur much in normal writing just like people authors writers will you use TK meaning find such and such a date data needs to be inserted later but I don't want to interrupt the flow of writing let me put in TK because it doesn't really appear in natural English much uh in terms of structured thinking the way I approached it was

00:26:19 during that period of time in my life it was interviews tracking people down conversations emails reading so ingestion let's just say for the workday then a break for training and and actually using myself as the human guinea pig for various things that had surfaced that might be on the docket where were you training at that time San Francisco is not uh famous for amazing

gyms it's not famous for amazing gyms at the time I was training mostly at a Climbing Gym called Mission Cliffs they didn't have much but they had barbells

00:26:55 and they had and they had kettle bells I also had in the walkway leading from the front door of the apartment I was renting it was more of a house the front door all the way to the first set of stairs there were 30 K kettle bells so various types and I was training for certification because I wanted to put myself on some type of deadline with accountability for that type of training to get a better understanding of it so trained for a few hours I also had developed a friendship with Kelly

00:27:22 starett so San Francisco CrossFit who I have tremendous amount of respect for likewise on multiple levels and his new book yeah built to move his great book he's so good yeah he really not only talks the talk but walks the walk and exemplifies many of the capabilities that he teaches which I take seriously I like practitioners not just the people with pretty theories although the theories are important I prefer to see someone who can actually put them into practice so Kelly served that function uh

00:27:55 certainly and we're still very close friends and then after that all right shake off the cobwebs get the body moving get the brain moving also eat and then I would actually focus on synthesis so I would write generally from let's call it 9:00 p.m. or 10 p.m. through to 4 or 5 a.m. and I would ride the wave if I happened to be in the zone if I weren't in the zone I wouldn't force it and I would try to get more sleep but I have always performed best with my writing in those witching hours of let's call it 10: p.m.

00:28:32 to 4:00 a.m. and my experience is that the writers I've interviewed the writer friends I've become close with if you look at when they made themselves not necessarily what they do now right but what they did that eventually got them to escape velocity they're almost always doing most of their writing very late at night or very early in the morning when the rest of the world or their social group is inactive wow yeah and I say wow because uh of course all of this was prior to the publication of Matt

00:29:08 Walker's seminal book right why we sleep which I really see as the book that shifted a lot of people fortunately from the I'll sleep when I'm dead mindset uh to I'll you know to really paying attention to it and um you know I don't think that gets enough credit I mean there uh there's been a revision of a few points within that book but the majority of it is just spot on and Hyper legitimate so good and um and yet what you're describing is a schedule that you know starting to write at 9:00 p.m. and

00:29:37 finishing up around 4:00 a.m. but you talked about research earlier that day and training and eating so were there naps in there I would sleep from say 4: to maybe 11 or 12 so I would be getting up later and I've had conversations with Matt about this and there are night owls and morning Larks and there are certainly differences in the code meaning the genetics but that worked very very well for me for a very long time it is however a very challenging social schedule so once you have a significant other and every

00:30:15 girlfriend I've ever had is a morning person if you want to spend time together that schedule just does not work so I made compromises later for the social side of things but if if you put a gun to my head and said you need to write the best book humanly possible that is your only priority outside of some exercise and fuel I would follow the same schedule I know several um very successful podcasters Lex fredman in particular who I think he's trying to follow a more normal schedule now but he's pseudo nocturnal at least by my ex

00:30:46 my read yeah um and there are couple other uh online content creators um Derek from more plates more dates who's hyperproductive in his domain and is mostly nocturnal um and then as you're describing your writing routine and your overall routine I was thinking that you know the the great skateboarder everyone knows Tony Hawk who is obviously a great skateboarder no doubt about that but Rodney Mullen who invented the all on Street the kickflip the all like Rodney is basically nocturnal and has been for

00:31:17 a long time and would you know skateboard up and down the bordwalk in Santa Monica in the middle of the night because lack of distraction is really was and he's been doing that since his teens I don't know what he's doing these days but I think a lot of creators just need space and and I always wonder if that's because when they at least the ones that are not uh socially dysfunctional like yourself who when they are around people there's this almost hopefully a desire to interact so you almost have to remove the stimulus

00:31:46 completely yeah it it removes the plausible deniability which might not be the perfect use of that phrase but in the sense that you it's harder to fool yourself into thinking you're doing something important when you're checking your messages or social media at 2: in the morning who are we kidding folks you should be writing in this case right and writers will do anything to avoid writing I remember IR Rand wrote a book about writing which is actually fantastic I can't remember the exact title it might just be on non-fiction

00:32:15 writing something like that and she talked about polishing the sneakers or the shoes before writing like I really just need to do this one thing which is to just clean up that shoe because somebody should really clean it up and at some point I should clean it up and therefore why don't I just do there's no time like the present I'll just do that it's all to avoid writing which is the harder

thing and in my conversations with Matt also I should say that as someone who has self-described as a person who struggles with onset

00:32:44 insomnia Matt made the point and sometimes we need to relearn things maybe you should just go to bed later sure and that might address some of this onset insomnia and I don't know the causes for that but I do get a Second Wind very late could be related to some cortisol release abnormality or just different scripting in my system who knows I'd like to take a quick break and acknowledge one of our sponsors athletic greens athletic greens now called ag1 is a vitamin mineral probiotic drink that covers all of your

00:33:17 foundational nutritional needs I've been taking athletic green since 2012 so I'm delighted that they're sponsoring the podcast the reason I started taking athletic greens and the reason I still take athletic greens once usually twice a day is that it gets me the probiotics that I need for gut health our gut is very important it's populated by gut microbiota that communicate with the brain the immune system and basically all the biological systems of our body to strongly impact our immediate and

00:33:43 long-term health and those probiotics and athletic greens are optimal and vital for microbiotic health in addition athletic greens contains a number of adaptogens vitamins and minerals that make sure that all of my foundational nutritional needs are met and it tastes great if you'd like to try athletic greens you can go to athleticgreens.com huberman and they'll give you five free travel packs that make it really easy to mix up athletic greens while you're on the road in the car on the plane Etc and

00:34:11 they'll give you a year supply of vitamin D3 K2 again that's athleticgreens.com huberman to get the five free travel packs and the year supply of vitamin D3 K2 I'll mention one other one other maybe shuris that I use for trying to peek around Corners which is if I find an example of an outlier trying to find two or three right because one is an exception two is interesting three is worth investigating that's sort of how I think about it and I recognize the plural of anecdote does not equal data however a lot of

00:34:48 interesting discoveries begin as case studies or case histories and so there are some things we could talk about that that I've paid attention to over the last few years that are not in the for our body that I think are quite interesting and raise very very exciting questions uh but I'd love to hear about those yeah and and along the lines of what I call anic data I mean most of what we know about human memory stems from one patient hm who had his hippocampi removed for epilepsy and of course there have been Millions probably

00:35:21 close to millions of studies in animals and humans focusing on the hippocampi but most of what we know about human memory is from one guy yeah yeah exactly so there's there's there's a lot to be examined not all of it will get funding for rcts let's be realistic this is especially true if you're hoping for any type of directive data and notice I'm not saying conclusive but if if you are a human who's going to be making decisions about diet Health exercise if you want any consensus you're doomed

00:35:51 you'll be you're not going to get any answers before you die can you say that twice so that the internet can hear it extra loud and clear for those of you that are arguing about nutrition on Twitter like it it might actually be life wasted yeah I mean I'm not being judgmental I mean I think that there's validity in lots of those Pockets there's stuff that's wrong in lots of those Pockets yeah um their diets that work extremely well like you know 4-Hour diet or slow carb I always call the 4our diet but the Slow Carb Diet it works

00:36:21 extremely well anytime I've followed it you I get much leaner and stronger and all that stuff um uh that it's uh purported to do it it works um but yeah maybe you could just uh explain what you mean by that because I think there are some argument slf friction spaces that that are truly an energy sync yeah I would just say focus on what works for you and your family or your team and if you're arguing on the internet recognize that you're just doing it because you like arguing on the internet you're not

00:36:52 going to convince anyone of anything and uh you're just going to make yourself uh more frustrated if you plan on changing any opinions so for me it's Live and Let Live and uh the more people who engage in that type of behavior the more competitive Advantage do you have if you don't so for me I'm like okay if you want to spend this vital non-renewable resource of yours called time on that if I ever compete against you I'm going to win so great I'll just uh I'll I'll also not even try to convin you to stop doing

00:37:28 that unless you see the logic in it which I have which is why I also don't have at least for two years have mostly had no social apps installed on my phone uh and we could talk about that because I think recognizing that these things have been engineered to overcome any type of self-discipline with billions of dollars at stake uh should lead you to believe that you're bringing a a knife to a gunfight so I just don't have the apps on my phone to begin with and I find it much more gratifying to see disproportionate

00:38:02 change from small inputs so that's what I'm looking for and I'm also looking for changes that are easy to make that can have high adherence that have very limited downside which is very different from proving something for instance in the 4our body took a look at the potential effect of cell phones or the proximity of cell phones to say gadal function and reproductive health

and the literature that was available at the time was very limited had some animal studies mice rats
Etc I recognize humans are not just large mice

00:38:44 so they don't always translate but I looked at I said okay looking at this simplistically
is it plausible that there could be similar effects on humans seems to be the case also based on
conversations with people people who are Specialists but would never go on record therefore if
your phone is in your pocket just have it on airplane mode I mean it it does not have a high cost and
and then pending any revision we can see but while the jury is still out I'm going to risk mitigate by
taking this step yeah well and I just want to say

00:39:21 thank you there too I read that recommendation I followed the recommendation of
not keeping the phone on in my front pocket or back pocket um and that's anic data um my sperm
analysis isn't relevant to this conversation but worked out but you know you could say well that's
not necessarily because you had the phone off but um I did a very long detailed episode on male
and female fertility there is now a what I view as a really quality metaanalysis and it's pretty clear
that there are effects of the

00:39:53 smartphone on proximity of the smartphone when it's turned on uh that are not
good for sperm isn't necessarily going to render somebody sterile but um on sperm that can be
separated out from the heat effects and so essentially this is another instance in which uh you were
you were right um and I think more data will come out and am I a EMF conspiracy theorist uh no um
do I wear tinfoil underwear no um but uh I think it's interesting I think it's important and uh thanks to
you um queued my attention to it in fact ||

00:40:31 teach about that in a a course on on neural circuits and biology and health and
disease amazing and I don't expect to get everything right at all that would be crazy i' like to think I'm
not totally crazy and it's very important if you are going to do self- experimentation or
experimentation in small groups which the Quantified Self community did quite well and I think still
does quite well you should really make every effort to not fool yourself which is hard it's it's
challenging at times but read books

00:41:07 like bad science read books like How to lie with Statistics ensure that you are able to
read studies well you don't have to be the best in the world but that you can on some level identify
the strengths and weaknesses of studies this doesn't take a long time certainly our friend petera Dr
petera has studying studies which is a multiple part blog series dedicated to this there are other
ways to approach it I took one of his podcasts republished it on the Tim Farah show because it
talked about how to

00:41:38 examine studies what powering refers to things like this in the span of one or two weeks you could really become literate with the building blocks of scientific literacy with respect to reading studies and that gives you such an enormous life Advantage it's hard hard to overstate yeah I agree and I also think that there are a lot of things that just simply will not ever be explored in a randomized control trial um one of the things that Peter and I have talked about before is he texts me you know what are your thoughts on

00:42:10 bpc157 this is a gastric peptide that's now been synthesized so people will inject it into a tissue that they're trying to heal or improve lots and lots of anic data on bpc157 making injuries heal faster Etc again anic data I've used it I took an injection of it yesterday in fact um Peter basically is not a Believer because there a lack of published data on this which is perfectly fine or I should say he's um skeptical um and so there's always that possibility of a placebo effect but I don't think there

00:42:46 will ever be a really nice controlled trial on bpc 1570 because the financial incentives aren't there and no smart graduate student is going to go do a thesis on this that so that's a reality I mean maybe one will do it now that we're having this conversation but it just doesn't that the payout isn't there yeah and that last one you mentioned is one that people miss a lot people doing these studies are people with careers who are planning their careers and so they choose what they're going to invest

00:43:14 time in very carefully so that's another limiter on what will end up in an RCT or not right so uh I think that's good for people to hear and as you get more involved with science and in my case through a foundation you know Cay Foundation funding a lot of early stage science you realize how expensive it is and how long it takes it is a long-term investment and if you are looking to make behavioral changes or modify aspects of yourself cognitive physical psycho emotional or otherwise identifying interventions right options

00:43:53 that seem to have some plausible upside like there is a a mechanism that might make sense in humans if you feel fairly certain there's very limited downside which should include talking to people who are presenting their results as anic data then maybe you consider using X if you can cap your downside right and I recall for instance looking at trans Resveratrol specifically not for longevity but in potentially increasing endurance for for our body and I ended up testing it and there's a funny story

00:44:32 associated with that didn't quite work out as planned and I don't use it any longer but what I experienced prior to actually finding this on forums was joint pain elbow pain the one most consistent side effect was what felt like tendonosis in the elbows and then I went online and I'd already done this but I hadn't come across I think it was the 500 group people have been using

500 milligrams of trans res trol daily for long periods of time and one of the most common reported side effects is joint

00:45:03 pain and I was like okay I'm not willing to make that trade-off yeah and makes sense to me yeah I think um it would be fun if ever you were willing that we could do uh a hybrid podcast on supplement fails I have some spectacular failures as do I and I'm thinking I'm thinking about a few of them I mean some that were really um like took me off course like there's one supplement uh called bulbine natalensis this is another another one of these shrubs sounds like an infection I mean this thing will really spike your

00:45:40 testosterone and free testosterone I'm talking back acne like huge strength gains aggression it's really wild and then after about seven to 10 days it all crashes and you go below Baseline oh sounds Terri yeah even testicular pain so it was unclear so you if you're a smart person you use right so I can understand why people are skeptical of certain things and then of course there are supplements that I'm a big fan of and that you're a big fan of we talked about those things elsewhere but um it might be fun to do supplement fails

00:46:08 podcast if ever you were willing that would I could do just experimental fails oh yeah yeah n of one experimental fails which include things that people might not think about for instance for our body had quite a bit of real estate dedicated to looking at things like PRP so PL rich plasma I think there's a rooll for it it's not useful for everything but for certain types of injury or repair I think it's very interesting um but uh every time you get injected this is where you have to be careful because

00:46:41 there are very few free lunches out there there's there's usually some type of feedback loop your system is very smart at Auto regulating things this is this is outside of that a consideration that I hadn't made which is every time you have an injection there's a chance of an infection particularly if the sight in my case was the elbow and the injection was made for the PRP not quite where it should have been slightly to the rear of the elbow where the the skin is very thick and so it pushed uh stuff bacteria from a mid

00:47:18 layer of the skin into the joint capsule not good and that really could have ended very poorly I ended up having to go to the ER and get it get it all removed and so on but that could have ended up uh in a in a much much more severe situation so you do have to be careful with this stuff I've become a little more conservative with some what I do including injections I'm like all right like let me think twice about the injections if I'm going to swallow something let me make sure I'm really looking at the implications for the

00:47:49 liver yeah smart very smart I'm curious about some of the things that you talked about in the 4-Hour Body and the that you've mentioned today things like accelerometers continuous glucose monitors deliberate cold exposure how many of those things are you still doing on a regular basis and how many do you um you know use a couple times a week or a couple times a month or go through phases of using and not using cold exposure I use as consistently as is practical so if I'm traveling it's a little harder but we're

00:48:22 in LA right now one of the first things I did was find a few options for contrast therapy MH one of the first things I did and by contrast I do not mean infrared sauna and cold plunge I'd much rather have hot and cold water just in terms of sort of speed of heating the Japanese approach right for just speed of vasodilation particularly for injury recovery I think it's incredibly helpful for mood regulation certainly that's the case and cold water for mood regulation or the treatment of say depression or as a pre I've intervention

00:48:58 to avoid or mitigate depression is old used to be prescribed for melancholy and people like the Vos of the world would be prescribed cold baths so that was something I was like well let's take a look at some of the old history read about that and then look into PubMed and so on to see what might be supported so the cold I'm still using I become increasingly interested this was not in the 4-Hour Body but whole body hyperthermia often excluding the head for depression which I know there's some some research UCSF ex right now yeah

00:49:36 really interesting studies too early to report I'm not involved in these but I think these are really important studies because for all the people saying oh well you know it's ice bath stuff you know metabolism this metabolism that one thing that's very clear is long lasting very significant increase in the catechol means dopamine epinephrine norepinephrine um not a replacement perhaps for anti-depressant medication but as you said to to move the needle toward anti-depressant States um that's the cocktail and um heat as well yeah

00:50:08 yeah and the hypothermia especially the way is formatted right now with some of the research is is very early stages there's going to be less adherence it's not as readily available say cold shower cold bath so I do think about the Practical implications of that but right now it's it's very interesting slow carb diet still use it all the time it is not my default 24/7 as it used to be so maybe I'm just getting older and more self-indulgent but if I find myself going off the rails a bit and I'm like

00:50:34 okay I'm getting closer to Muffin Top here let's stage an intervention then I will go immediately back to slow carb diet and within within a matter of weeks it's it's pretty easily corrected and just a cue for people I know it's um you know slow carb diet um achieved great prominence in fact wasn't it featured on uh or mentioned in an episode of Orange Is the New Black I

it might have been it's made it's made appearances on a handful of shows great I realized that I've been referring to the Slow Carb Diet several times

00:51:05 throughout this discussion so for those that aren't familiar with the Slow Carb Diet I know they can go look up what that is but so that we can keep them here uh for the rest of this discussion and not have to send them out and back uh just yet um could you give us just a brief top Contour of what the slow carb diet is sure so slow carb diet is intended to be a simple easy to adhere to diet for people who have perhaps failed other diets that allows you to recompose your body so improve muscle mass decrease body fat percentage and

00:51:39 the rules are really simple and that's part of what makes it work it's not ideal for every sport in every circumstance but broadly speaking it works for a lot of people who've had trouble with dieting in the past so rule number one don't drink calories that's it very simple so black coffee unsweetened tea great juice out anything with calories out you could add a little bit of heavy cream to your coffee let's say uh but that's that's also bending the rules in a way that I don't like so in the beginning it's like

00:52:11 follow the rules so you can break them later so in the beginning let's just say you can't drink calories number two don't eat anything white sounds pretty basic right just don't eat anything that is the color of white or that could be white basically that means you're going to be avoiding starches and uh things that are are similar to starches that includes things like oatmeal that includes things like oatmeal so roughly speaking just avoiding things that are white or that could be white will get

00:52:38 you pretty far and yes there are exceptions like cauliflower fine you can have cauliflower but again don't get fancy right it's it's very easy to outsmart yourself when it comes to behavioral change keep it simple so for at least two weeks forget about the exceptions right don't drink calories don't eat anything white and then eat 30 grams of protein within 30 minutes of waking up okay got that and then there are a few buckets you can choose from right so you have vegetables beans and lentils uh and then some type of protein

00:53:16 so you're going to come up with meals that you can follow without deviating for a period of one or two weeks just come up with the same meals and that's going to sound boring yes but guess what you do it already you just might not realize it and the the lentils and the beans specifically as a prere we can get into some of the reasons but add a lot of fiber and also inhibit appetite right so that's actually a very important component of these meals and there may be a handful of other rules but those

00:53:48 are the basics and then the Redemption is take one day off per week and just go crazy that that's cheat day there are some epic cheat days out there some I've captured for myself and anything goes when I say anything I do mean anything so if you want to consume multiple pizzas pints of ice cream whatever indulge I left one out no fruit during the week so avoid fruit avoid fructose so agave nectar anything that is sort of hidden sugar avoid all that uh it's a no added sweeteners obviously but avoid avoid fruit and fructose and

00:54:29 again it's not going to kill you guess what if you're from European ancestry your ancestry did not have like blueberries in the middle of winter generally speaking right so you'll you'll be fine for a few weeks um and then there's that cheat day and cheat day anything goes the amount of damage you can do on cheat day is pretty limited and there are ways you can mitigate that there's a whole chapter called damage control in the 4our body but focusing just on that diet and having one one day off where you know

00:54:58 you can do anything means when you are controlling yourself for those six days of the week you're not giving up your favorite foods forever you can even keep a list of all things you want to eat on cheap day and then you have free license to eat on cheap day and that provides you with a release valve so that you can build in the cheating as opposed to having it occur as a failure point there are a handful of other things there if you have Domino Foods in the house for instance if you eat a lot of almonds or mixed

00:55:30 nuts and you're just going to sit there compulsively eating them while you're sitting at your laptop don't have what I call dominoe Foods in the house which are going to really create some portion control issues but broadly speaking don't drink calories don't e things that are white take from three categories and build your meals out and those are the meals that you follow do not eat fruit or fructose and then cheat one day a week and Saturday is a nice day or cheat day for most folks FKS and uh just to

00:55:58 answer some questions people are going to have no that doesn't mean 24 hours that you can spread out over two days that will actually say you back but the amount of fat that you can store in a handful of sittings over 24 hours which legitimately is more like 12 to 18 hours pretty limited um so that's slow grab diet great thank you for that I also want to ask is it okay to take the day after cheat day and fast or do one meal that day when I followed the Slow Carb Diet I benefited from it tremendously

00:56:35 lost fat gained muscle tons of energy sleeping great uh required less caffeine all sorts of wonderful things stable blood sugar I felt so so good um really enjoyed the cheat days I really really enjoyed the cheat days so much fun um at some point there's some gastric distress that comes from you know not regulating intake um which led me to not want to eat the the next day

MH um so I tended to do the cheat days on Sunday in my case um and then I would fast most of Monday just water black coffee tea and

00:57:07 then I might have a small meal in the evening and then by Tuesday I was back on the Slow Carb diet does that seem like a um an uh sort of a detrimental deviation from the from the plan I think that if that is what works for you then that is what works for you so this is this the Slow Carb Diet template for me is a starting point and generally I'll say I think this is from Picasso right it's like learn the rules as an amateur so you can break them as a professional but it's like I recommend most people kind of stick with

00:57:37 the format for a handful of weeks and measure the results right there so there are guidelines for how to measure the scale is a bit of a blunt instrument so there are other ways but if you're extremely overweight you can just use the scale and fasting I think is fine or just ratcheting back your caloric consumption significantly uh and what happens over time for most people also is for the first say four weeks on cheat day you're going to go completely insane and I remember I was doing something much

00:58:13 stricter called the cyclical ketogenic diet which is a whole separate thing it's much more limiting in terms of what you can eat but I was training for ultimately the Nationals in Chinese kickboxing this was happening in 99 so I was training super hard I was following a cyclical ketogenic diet which meant I could eat very few things but I did have this one cheat day and I would do a glycogen depletion workout beforehand which is one of the things you can do to limit the damage on cheat day do a glycogen depletion workout

00:58:42 beforehand and then I would just go crazy I mean I would drive to like crispy K cream by 12 donuts and they would be gone by the time I got home and it wasn't an hour away it was like a 10-minute Drive Donuts would be gone right I would go to Safeway and I would buy a bag of those funsize Snickers and that would be just a tiny portion of my calor stuff for you huh a lot of sweet stuff I also did the Savory stuff I mean I had my favorites nothing was safe Pizza nothing was safe nothing was safe my my Paws got into everything and then

00:59:15 over time because the next day you're going to feel like you got hit by a diabetic dump truck you start ratcheting back and you're like okay maybe I don't need to do that maybe cheat day will just be two meals or maybe cheat day will just be like the pastries in the morning with the coffee and you start to regulate a bit generally you don't have to but over time you generally will and I think after you've followed it to the tea just follow the Commandments for say four to eight weeks then you can certainly

00:59:47 deviate and I'm not saying if you're not hungry don't eat however in many cases people have they have acclimated to not eat eating in the morning and then they end up overeating later in the day if you have that habit right if you're consuming 50% of your calories or more at dinner and you want to lose body fat I would say get some cottage cheese or something that will give you 30 grams easily in the morning worst case scenario use a protein of some type just don't make it hypercaloric you mean

01:00:22 powdered protein like could be powdered way powdered way protein whole food is going to do a lot more MH and no calorie counting correct no calorie counting tends to be self-limiting when you're eating this much fiber and this much protein it tends to be very self-limiting what you'll want to consume and what you can consume yeah once again I had great experiences with slow carb diet and um I'm going to go back on yeah and nobody and uh nobody needs to buy anything to figure it out if you just search on tim. blog slow

01:00:52 carb diet there you'll get everything that you need to get started no purchase necessary well it works very very well I'll say that and it's very straightforward to follow and it does include the the notorious uh cheat day uh Infamous cheat day um uh and it can be done um on a very reasonable budget and so if people want to learn more about that they should go to Tim's blog on 4our uh um 4our body and um slow carb diet we'll provide a link but it's you know I think it's worth highlighting again just how effective that is you

01:01:26 know as you pointed out thousands and thousands of people um using it to great success some of whom were um quite obese and um yeah any updates on those folks are they still keeping the weight off I would like to do a followup uh it's I think with diets in general there's a lot of reversion to the mean you know regression to the mean so I would expect that that some have kept it off and some have not that would be true of I think every possible diet especially for people who are overcoming beh avoral inertia of having gained

01:01:58 hundreds of pounds but uh I'd like to do some followup what was fun about the post I put together called how to lose 100 pounds on the Slow Carb Diet we had we profiled say four or five people but there were dozens and dozens and dozens and dozens and this was a very long time ago so I would say that a long-term followup would be super interesting and we did at one point track several thousand people through a platform of the time I think it was coach.me as they follow the Sol carb diet for the first four to 12 weeks and

01:02:32 that was fascinating because I want the data and I'm happy to be proven incorrect with any of my assumptions I mean I I don't view that as a failure me I view that as as a huge net gain and uh it has a very high adherence rate so I I pay attention to not just is something effective does it get you the outcome you want not only is it efficient from a Time and resource perspective but how

high is the adherence rate right so if you take a random sampling of a thousand people from the US across socioeconomic

01:03:05 classes Etc how many people practically speaking will be able to or willing to follow this for say an eight-week period of time or four-week period of time and I try to optimize for the widest adherence because I know the the sil CB I people come on they're like what but what about intermittent fasting what about this and what about endurance athletes I'm like this is not for everybody in cases it just happens to be a good default diet with a high adherence rate and like you said it's very inexpensive it can be followed very

01:03:34 very inexpensively could sorry to interrupt you one thing that I really like about it is that um many uh variants on caloric restriction which is because laws of thermodynamics definitely apply folks we're not we're not trying to say they don't um but one of the issues with a lot of things including intermittent fasting which I sort of do some variant of because I'm not really hungry to eat until about 11:00 I like to train in the morning if I can Etc is that they can sometimes prevent best performance in terms of especially

01:04:05 resistance training high-intensity resistance training so very low carb diets I've tried them um even if you're paying attention to you know other ways to restock glycogen it performance drops off whereas a slow carb diet I feel like I can think I can work I can exercise I can sleep like everything just works well but there's one thing in it that I wanted to raise that I when I heard this I thought there's no way this is true which was uh making sure that you get 30 or so grams of protein within 30 minutes

01:04:32 of waking yeah and I thought how can that be like how can adding protein early in the day actually make a difference and it really did work I was I still track my numbers so in terms of dropping body fat percentage increasing muscle it really does work now whether or not that's simply because it's offsetting food intake that I would have um food that I would have taken in later in the day I don't know I I don't I'm not going to make myself my own control experiment to the point that I drive myself crazy yeah but um it really does

01:04:57 work quite well um to get past sticking points to just get that 30 g of protein early so violate the the uh um Tim restricted feeding component deliberately with some protein in the morning y then still train and do all the other things and you know carry on as usual and it's just so it seems so peculiar like eating more and and losing body fat but it works yeah it's counterintuitive and a lot of approaches can work for a lot of different people right to State the OB but this particular aspect of this low

01:05:29 carb diet is helpful for let's just say the majority of the people in that thousand person sample I was talking about the hypothetical Pole from different parts of say the us or anywhere because it it seems to help with a few things first there's just the thermic effect of food and for protein there's a greater thermic effect you also have and I think there's there's decent at the time there was decent literature to support this so I don't know if it's changed that the protein intake along those lines has an appetite

01:06:03 suppressing effect so the The Net Daily calories consumed tends to be less when someone has a higher protein meal earlier in the day and last but not least I will say one of the risks and there are many people who execute well on this but you have to be very meticulous which is true of the ketogenic diet as well you can get yourself into a lot of trouble if you do it 60% right or 70% right you're really you can get yourself in there massive psoriasis I mean my scalp you know slopping off from like when I'm in

01:06:34 ketosis and going like what the hell is going on you're going back on some complex carbohydrates and it going away yeah I exactly I don't need I don't need a randomized control trial to know I simply don't want to run that experiment your scalp yeah so in the case of say Tim restricted feeding some people who do intermittent fasting lose a lot of muscle mass and there are multiple reasons for this I I think people should make use of relatively widely available tools like dexa and so on to ensure that

01:07:06 your composition is actually moving the way you think it's moving uh make sure you standardize your hydration for that as well as time of day just Pro tip that's true for blood tests as well but it seems to get net net better effects than trying to teach people how to fast effectively which you can do and we can talk about fasting that's something that was not included in the 4-Hour Body that were I to rewrite it today I would include a section and there was a bit in tools of Titans to address that on more extended fasts

01:07:37 let's just call it three to 7 day fasts uh so that's an area that's of great interest to me as is ketosis and metabolic Psychiatry I'll Chris Palmer yeah who we both know incredible I mean what he's what the Awakening that he's uh created through his book and going on your podcast my podcast and others and and you know letting people be aware that changes in diet can impact mental health so I think in two three years it's going to be a duh and we're not just talking about the difference between you know um slamming back

01:08:11 horrible Foods horrible for US Foods versus eating really clean I mean really specific diet protocols to treat mental health incredible yeah super exciting so that's that's one of the things that I'm paying a lot of attention to right now they're a handful in that r within the just say the the interplay of Mind and Body since The cartesian Duality and separation of this too makes no sense

from a biological standpoint so um that's that's something that certainly captured my attention and I paid a lot of attention to even as far

01:08:43 back as early 2000s uh for mental health and just cognitive performance I'd like to take a quick break and thank our sponsor insid tracker insid tracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate and long-term Health can only be assessed with a quality blood test the

01:09:10 problem with a lot of blood in DNA tests out there however is that they'll give you information about certain lipid markers or hormone markers but no information about what to do with all of that data inside tracker makes it very easy to look at your levels of hormones metabolic factors lipids ET ET and then to assess what sorts of Behavioral nutritional supplementation or perhaps other interventions you might want to use in order to bring those numbers into the ranges that are optimal for your

01:09:35 health for this week only the week of June 19th 2023 insid tracker is offering a buy one get one free on their ultimate plan this is their best discount of the year you can get this offer by going to insidetracker docomo again that's insidetracker docomo thanks for uh revisiting some of the 4-Hour Body and slow carb diet and elaborating on um some of the process that went into that and I think uh creators of all kinds thinkers of all kinds and people who are interested in the contents of the 4our body are going

01:10:08 to be uh very grateful for that information I certainly am fascinated by your process um one of the things that you mentioned along the lines of process was you know the power of places and where one happens to live I think there's a essay by Paul Graham that talks about this it's a little outdated um you know and it talks about the messages that you um the tacit messages of being in certain cities I think it was you know like Boston you're not smart enough um what was it it was New York uh you're not powerful enough

01:10:42 uh and not you I just thinking and um or you should be more powerful is the message like the tcid message um Los Angeles um what you're what you're doing people aren't paying attention paying enough attention to it like that messages these are stereotypes about cities certainly cities change um the role of places is an interesting one like you know you mentioned you know small gathering Kevin Kelly's house Quantified Self and I think for people who don't know people like that right um maybe we could get your thoughts on you

01:11:14 know how would one think about where to live and maybe even curating their own Gatherings useful Gatherings because it's not that uh I have to imagine it's not that you guys sat back and like I'm Tim Ferris he's like I'm Kevin Kelly let's have a gathering so we can talk about it in a few years on a podcast this stuff happens MH that word you know it's dangerous word organically um when people who have common interest decide to get together and talk and listen and brainstorm and I'm yet to do that in a

01:11:46 you know with good people and not have something really incredible come out of it not necessarily that day yeah but looking five years looking back five years later and just God that was really worthwhile totally yeah few thoughts in no particular order I would say the first is it depends my recommendations depend a lot on where you are in the Arc of your career in life if you are in full growth hyperdrive mode and you are trying to build both yourself and your capabilities in a very concentrated way

01:12:23 where you're not necessarily focused on family maybe have fewer obligations then if you're serious I think many people should consider moving to an area of high density for a period of time it could be three months it could be six months could be longer but putting yourself in a New York or an LA or San Francisco or Chicago or as new places develop I'll I'll give you one you might not expect say in Ottawa Canada where Shopify is based and the presence and growth of Shopify has spawned an entire ecosystem of startups

01:13:04 so there may be options outside of the usual cast of characters Pittsburgh and dualingo similar effect so there are more options than people might recognize but taking a journey and placing yourself in a place where you can be in a very active pinball machine where you may interact act serendipitously with many different people from many different worlds I think is is hard to overstate the value of and my drive and my filtering function let's just say because when I first got to the Bay Area nobody cared

01:13:42 about me I was nobody I was driving my mom's used minivan hand me down that had the seats stolen out of the back it Terri were you in the South Bay I was I was working in San Jose yeah I mean no disrespect to San Jose I'm from the South Bay yeah but there's a there's a bleakness to the South there is there is a little bit of bleakness and then I lived across the street in this tiny apartment lived across street from the Jack in the Box in Mountain View so it's not like I was strolling onto the big

01:14:08 stage and just blowing people away oh I I I grew up right near Mountain View I'm very familiar probably skated the curbs at that Jack did you train at the Golds Gym in off rang store did actually amazing that was a great gym that was a great gym that was a great gym I don't think it's still there I'll go there super late before my writing sessions okay and it had the benefit of being open

really really late and wow rang St haven't thought about that in a long time so the point is I also started

01:14:34 where a lot of people are starting and what did I do I put myself in a high density environment next what did I do knowing no one I started to volunteer at events where they had interesting speakers and interesting people coming to hear those speakers so I put myself in Silicon Valley and then then I began volunteering for groups like svases I don't know if it exists anymore the Silicon Valley Association of startup entrepreneurs I think it was Tai the indust entrepreneur which is a very sort of Indian or

01:15:08 indian-american focused organization that does a lot in the realm of startups and I would carry water I would take out garbage I would check name badges I would check people in nothing was too low for me and I'll give you guys a tip that will be obvious to some but nonobvious to many when you're are volunteering a lot of folks who volunteer do the absolute bare minimum because they are not getting paid this is not going to get you noticed but it sets a very low bar so that if you volunteer at these events and someone's

01:15:44 dropping the ball or there's something happening that needs fixing and you just proactively do it the producers of these events will notice you and this is what happened over time over a few months and then I got invited to join in on meetings that were planning future events and I eventually got to the point where I was recruiting speakers and able to set the agenda for an entire main event and then that's how I got to know say Jack Canfield who is the co-creator of Chicken Soup for the Soul and many

01:16:13 others who introduced me to my book agent many many many years later Jack Campfield but I was a nobody then you have to play the long game but you can be methodical on how you play that and that is one approach just as an example for how to build your network which snowballs over time don't hump every vip's leg within 10 minutes of meeting them play it cool you know and and Gatherings where that person is uh has a lot of Demands on them is the last place you want to do that the way you're going

01:16:48 to make yourself saleny to that yeah the way you're going to make yourself memorable with people like that is to be very professional always on time predict what they are going to need or problems they'll run into beforehand and address them before they even think of them and be easy to deal with and people like that high performers notice these things they will make note of it yeah the being easy to work with is something that um I used to tell my graduate students posts I mean it because the opposite of that nobody

01:17:19 wants yeah right nobody wants that yeah especially in the beginning like later okay great you're Steve Jobs you want to be difficult here and there or a lot no problem right but in the beginning that can be a real liability you can make up for that if you're the best in the world but in the very beginning you probably won't be uh so try to stack the deck in your favor volunteering is a shortcut and that would be one way of doing it another now especially given the virtual communities that exist so you have subreddits you

01:17:49 have online communities you have Twitter groups you have Clubhouse you've got a million different options which can be over overwhelming is Clubhouse still going maybe not I have no idea oh no I don't know I'm not saying it's gone I just I remember during the pandemic there were some Clubhouse Gatherings that hopped on there and but I've sort of forgotten to to get on maybe the the platform Affinity is really fickle which is why I think to the extent possible if you want to build a worldclass and I use

01:18:15 that term very deliberately Network in record time just to give you a nice headline I would say focus on the uncrowded channel which is in person it's out of fashion it's out of Vogue going to a conference and actually interacting with humans in the hallway approaching panelists this is another thing that I did I'll give it I'll give another tip so very early on I would go to conferences nobody cared who I was nobody knew who I was fine and I would study the panels let's say I'm going to a big event like South by Southwest and

01:18:49 I would this is what I did in 2007 which was just prior to the first book coming out and and I would go to these various in-person events I was focused mostly on events that had uh the Thematic focus of blogs we could come back to that but blogs were what podcasts were a few years ago right they drove incredible traffic but they were undervalued by mainstream media undervalued by mainstream Publishers Etc which meant there was an Arbitrage opportunity in a way and I would pick say a handful of panels with topics I thought were super

01:19:24 interesting and then the panel would end and what would happen the panelists would get rushed by various folks because many of them were wellknown who was not getting rushed the moderator I would go straight to the moderator and I would talk to the moderator I'd thank them for the panel i' would be very genuine none of it was made up and talk to them for a bit they would generally ask why I was there what I was interested in I would mention whatever that happened to be in this case it was I'm finishing my first book

01:19:52 or I had my first book coming out soon I'm here to hopefully meet people uh who are involved with a or C and then if we hit it off which was not true every time but if it seemed to be going well I would say is I don't know anyone here I'm really sort of orphaned here making my way through uh this entire event is there anyone else here you think I would get along with who maybe I

could buy a drink or coffee and vast majority of the time they like oh yeah you should meet so and so and then I get the introduction and then I would meet

01:20:24 that person I would have a genuine interaction with that person and if it made sense if things were going well I'd do the same thing is there anybody else here you think I should just say hi to and I get along with not who I can ask for something and that wasn't deception I was being honest like someone I could actually Vibe with and if so would you mind making the intro yeah sure no problem many of those people are still my friends uh and by being surgical in that way not trying to gather business cards

01:21:00 to use a really Antiquated metaphor people still hand them out yeah people still hand them out I guess depends on where you are especially like Boston but uh if if rather than trying to collect people as Pokemon cards developing say five three to five deeper relationships through longer conversations at an event that is what directly LED ultimately to the hockey stick for the 4our work week within Tech within specifically San Francisco um so those be a few approaches for for building your network when you don't have the

01:21:38 ability to just walk up to say Kevin Kelly and have a conversation that came over time yeah whether or not it's um Health practices or uh nutritional practices or at meetings seems you're oriented toward the crowded but very interesting people in spaces MH but the key word there I think is uncrowded and of course the other key word is interesting right I mean it's not like you're standing in the parking lot talking to whoever happens to be there although that can be interesting right there's a Serendipity there and you know

01:22:12 there's always um things to learn from people but in terms of uh career advancement and and building new ideas and forging for information I'm just struck how you've done that over and over um and again thank you for uh giving giving us some insight into the process please all right here's another one so I think there's a tendency among people who want to develop their networks or their relationships to be star not to get too technical but that's a technical term yeah yeah and they want to tell

01:22:44 other people they are friends with someone more than they want to develop skills or learn from someone this puts you in a very disadvantaged position because then that means all right you want become friends with Elon Musk good luck or you want to become friends with this a-lister celebrity who everyone else wants to meet good luck it's going to be a crowded bloody path to get there and by the way they've also certainly developed really attuned defenses against people like you so it's G to be hard on the they have staff to prevent

01:23:19 they have a fence of protectors to prevent you from ever getting to that person on on the other hand if you're approaching it from the standpoint of developing skills learning and actually becoming potential friends with someone give you an example you could go after you want to become better at boxing let's just make that up all right maybe not the greatest example skiing would be another one but let's let's stick with boxing just because of the way I'll explain it if you wanted to say get personalized lessons from Floyd

01:23:52 Mayweather it can happen okay let's go then maybe a step down out of the pro ranks to gold medalist okay if it's a brand new gold medalist let's just say like Oscar De La Hoya when he was really The Golden Boy and it just thrashed everyone still going to be hard what about the silver medalist who just had a bad day when he had that last bout against Oscar De La Hoya potentially right from a technical perspective from a personal connection perspective you may have more in common with that person or bronze medalist and

01:24:23 they can get you 70 809 0% of the way there and by the way you probably don't have the physical attributes to make it to 100% anyway if you're coming to it this late and you could get in many cases one-on-one lessons whether in person or virtually with someone who is of that caliber they're in the same front of the pack as the names I just mentioned maybe not as famous 100 bucks 200 bucks per hour for a lot of people that is Within Reach yeah I'm not sure what the value of saying one knows somebody very famous

01:25:02 is it's just never been something that I've oriented to it's a common orientation though yeah and uh I think that's true for a lot of things like many people use say psychedelics because they want to tell other people the story that they have of doing psychedelics right they're not doing it intrinsically for what they hope to get out of that experience maybe there's part of them but it's more more the social signaling and validation they get when they project that out at a group dinner into a story that they can tell and that's

01:25:32 true for many things so one of the questions I ask myself with all sorts of things if I could never talk about this would I do it what a what a great great right thing to think about right like if I could if I could have let's just say we didn't know each other and I was like okay I'm earlier in my career let's apply some constraints so I'm not where I am I still want to do abnc in the public eye maybe I want to build a podcast whoever if I could meet with you but I could never tell a soul would I do it I

01:26:01 don't know would you I would I would I would too but but for a lot of folks if they meaning I'd meet with you I'm not saying I'd meet with me by the way I'd mean with me you know the believe me I meet with me all the time and sometimes it's pretty unpleasant yeah and and that can be applied to all sorts of things right it's like and it's it's a useful question because I as myself

this for examining your motivations and I'm not saying one motivation is always better than another but it's it's you should at least be

01:26:29 aware of your driving motivations because you can end up playing games you're not even aware you're playing and that's how you end up I think getting into a lot of trouble in life one of the ways so that would be a question I might apply I apply other questions like there's a great question uh that Seth Godin applies who really I admire tremendously and has built an incredibly unorthodox unique life for himself and his family he's he he's zigged when everyone would expect him to zag and I I and he always has a

01:27:01 defensible logic behind it and much like Derek does but most people have probably heard the hypothetical question like what would you do if you knew you couldn't fail right or what would you do if you couldn't fail and Seth turns that around I think that's a good question but he turns around he said what would you do if you knew you were going to fail in terms of identifying what you would do for the process right what would you do if you knew it was going to fail okay you're considering these five different

01:27:29 projects let's say they're all going to fail but you still have to choose one of the five which would you choose yeah that's a great question um much harder to answer yeah and you know at the same time I'm called back to uh when I was a graduate student and still now with the podcast uh I have this um litmus test um which is you know is the experiment that I'm working on the one that I want to be working on most is the podcast that I'm working on the one that I want to be working on most I mean there's truly no

01:28:00 other podcast I'd rather be having today than this one right and the moment I'm starting to think oh I wish I was doing that thing over there I realize I'm off Target I'm off Target and um uh I think that asking really good questions is something clearly that you're very good at and uh getting a little bit deeper into your process around that do you write those things down like is there a Notebook someplace in the Kingdom of uh of Tim Ferris in Austin or elsewhere um that says you know those questions that

01:28:31 that essentially those questions are written are they yeah I collect I literally have a document with questions that I've gathered from Seth printed out and at the Airbnb where I'm staying here so you brought it with you I printed it out here and then I went through and I read it last night and I was highlighting questions from past interviews I've had with him on my podcast to revisit his questions so I I was literally doing that last last night over dinner and I collect questions I collect questions if I am reading a

01:29:00 magazine and I come across a good question I take take a photo or I capture it somehow in notes or in Evernote which I know is kind of oldfashioned these days but I've used it for everything so the critical mass is beyond enormous and I do collect and revisit these things I capture them in journals as well but I I absolutely capture good questions when I find them questions are so powerful for the brain I don't want to go into this in too much detail because I have a lot more questions for you but uh we just wrapped a series on

01:29:31 Mental Health um that will come out later this year with Paul kti and he um is brilliant as we both know and uh does truly important work and um and he pointed to the value of asking really good questions about oneself and the because of the way that questions that are really directed at self-inquiry ceue up the subconscious so you asked the question question and unlike a statement or a meme um the brain works with that in in the days and hours after asking the question in ways that um simple declarative statements probably don't

01:30:06 ping the system the same way which is probably why we can see so many points of wisdom and Truth everywhere and it doesn't necessarily transform us but asking really good questions really does seem to transform us yeah there there's uh I think judging people by their questions is it's also a shortcut to assessing and learning a lot about how someone functions and what makes them tick I think it was volter who said you know judge a man by his questions not by his answers something along those lines but

01:30:38 when in doubt attribute to volter it sounds good does sound good and I I think about this a lot I do think about the questions and I refine the questions that I ask myself especially while journaling because it's easier to cross-examine and stress test your own certainty and beliefs when they are captured on paper or digitally on a laptop for instance so I I do routinely revisit certain questions that I found helpful over time I mean one that people can play with is with whatever is really causing you consternation or stress at

01:31:18 the moment some kind of decision a relationship business could be anything just what might this this look like if it were easy right what might this look like if it were easy if it had to be easy if that were possible what might it look like and that could apply to anything it could apply to anything you know could apply to could apply to Fitness it's like look if you do really intense kettle bell swings twice a week with proper weight and load and time under tension and you do push-ups a few times a week and handle a couple of

01:31:50 other elements you can get in pretty good shape it's so simple but hits a lot I mean hits your entire posterior chain okay fine do some push-ups and some core work but if you're not exercising at all because you've made the assumption that it's four hours five hours a week rather than completely remove that objective and call it just impractical can you ratchet down the scale

how far can you ratchet down the scale until you have no excuses right that would just be one one example language learning Tech

01:32:29 investing applies to everything making life easier is something that definitely gets my vote yeah making it easier and making it more elegant right the more pieces in your life you have floating around the more contacts the more extraneous loose connections the harder your life is going to be the cognitive overload or overhead is really high so I'm always looking for maybe like Japanese a flower arranging it's like okay how many pieces can I remove while still like maintaining the essence of what I'm

01:33:00 trying to achieve you and Rick Ruben man I'm telling you you know two people I am fortunate enough to know personally and that I have tremendous respect for and you know the work and uh is self-evident you know it's really remarkable so uh rewind that and listen to that segment right there folks I'm telling you I've worked hard to apply it because it's not my default and boy does it make a significant Improvement to simplify simplify take some thought and question asking it's like you just can't

01:33:29 delete things at random so you get down to some fixed number but um I'd like to ask you about another area where you really have seemed to see around corners and this is one that actually carried with it significant risk um not necessarily risk to health and to life but risk in terms of outside perceptions and that's psychedelics MH you know I've substantially changed my view on this uh we don't need to go into my former stance on I talked about that when you were gracious enough to host me on your

01:34:02 podcast for a second time uh done some psychedelics recreationally as a kid it was correlated with um not so great times in my life stayed away from them then eventually Revisited MDMA in particular from a therapeutic standpoint found tremendous benefit again therapeutically with a medical doctor again these drugs are illegal uh soon to change perhaps hopefully and we'll talk about that but uh it's becoming clear from the controlled Studies by Robin Carter Harris uh there are many others okay Nolan Williams others um that these

01:34:36 drugs have enormous potential to help relieve depression trauma uh help people explore their psyche their mind for sake of feeling better doing better in the world for leaning into life not tune in drop out but um you know to really lean into life with more purpose and more satisfaction in some cases they've really have saved lives I think um what was your mindset around psychedelics when you first started exploring them what led you to overcome the inevitable you know fear Gap there uh because you

01:35:14 do seem like somebody who takes value in your health right you're not Wreckless you may have been more adventurous in the past with things like I hate the word but biohacking and self experimentation than you are now but but you obviously have some self-preservation mechanism intact we learn we learn we learn um what was your mindset around it at the time and then I want to get to what you've learned from it um and frankly the tremendous efforts that you've put that are now translating to tremendous value

01:35:44 for really millions of people and ultimately I think it's going to be billions of people um by establishing funding for the pioneering research in this area helping to promote the movement of these compounds from illegal to legal in the therapeutic setting so on and so on so take us back to um your first thoughtful exploration of psychedelics what would that look like you're like oh mushrooms all eat them was that it or was it um or or was it a a dedicated uh research process and who' you talk to what was it all

01:36:20 about so let's go way back to my grad experience and there were many reasons that I ended up going to Princeton I think I was very lucky to get in my SAT scores because I could never finish the damn test I was so much of a perfectionist I get stuck and ended up not doing terribly well but through S and other things ultimately was able to go part of the draw let me interrupt you and just say I think at this point we can say they were lucky to have you well thank you for saying that thank you for

01:36:49 saying that great institution and you've done great and you're a a a great um poster on the wall for them yeah really really yeah I just want to say it because you're not going to and I think it's important that these are great institutions have great minds go through there and you know Einstein went through there and uh and their success rests not just on the Einstein but also on the student body and what they go out into the world and do and not just in the realm of science so really they're

01:37:17 they're lucky to have had you yeah thank you Andrew I studied Chinese in a room where Einstein used to teach it's pretty cool t set foot and spend time weekly in a space that was shared by some of these people amazing it really it really gets the imagination firing if we go back to that chapter in my life I was initially a Psychology major with focus on Neuroscience so I want to be a neuroscientist and there are many reasons for that I have neurodegenerative disease on both sides of my family so Parkinson's and

01:37:51 Alzheimer's so that was certainly a personal driving interest in terms of looking at mechanisms understanding what Therapeutics existed or did not exist how things were developing in the research and while I was there which later I ended up uh Switching gears and transferring to focus on language acquisition and East Asian studies hence the Chinese that I mentioned earlier

and Japanese and Korean but on the Neuroscience side there were a lot of cool breakthroughs also that came out of uh Princeton

01:38:25 around that time looking at the amazing discovery of say uh neuronal uh I want to say Regenesis but neurogenesis in the hippocampus remember exactly exactly so there was quite a bit happening at that time I was a subject I loved volunteering for studies just to try to get an inside look at how things were done in some of Daniel Conan's experiments so it was a cool time to be there and within the first two years I want to say I had my first experience recreationally with mushrooms and looking back now I mean I'm

01:39:04 horrified by just the lack of control and meaning not control but lack of supervision right I mean the setting the set and setting ended up being fine nothing terrible happened but there were a lot of ways it could have gone sideways but that first experience and I must have consumed in retrospect just a dizzying amount of mushrooms I mean be in excess of five gram it would have been more yeah just knowing what I know now it would have been kids don't do this at all don't do that I'm not I'm not gonna say don't do it at home don't

01:39:33 do it at all yeah yeah please I don't think I actually don't think uh the young developing brain should be exposed to psychedelics we could talk about we could talk about that I'm GNA to take my stance I'm gonna take my stance for now yeah I mean in in the world in which we live in the US um I would I would totally agree with you um there are some interesting cultural exceptions in other places uh where there things are more set up to provide for that type of use but I certainly would not recommend it but but

01:40:05 coming back to my my recreational experience my my subjective experience was so bizarre and my experience of time so nonlinear my experience of self so different from anything I had experienced up to that point and therefore my construction of reality being so completely unlike anything I had experienced was enough to make me want to learn about these compounds and very early on I still have a scan of it somewhere I think it was in 1998 or 99 I actually wrote a paper one of my junior papers was focused on examining

01:40:48 potential similarities between RM sleep and uh LSD MH lsd2 uh and looking at some of the patterns of of neural activity of course we can do a lot more now with with the tools that we have available but from a scientific perspective I was very curious about how much we knew and how much we didn't know and I would say that latter category gets me more excited in a way I'm like okay how how much room is there for growth here right because if if we're just putting on the finishing touches with marginal you know incremental

01:41:28 improvements on something that we feel like we've largely figured out that's less interesting to me than something that baffles most people examining them on some level and there was a professor named Barry Jacobs who was doing some very interesting work he did a lot of work looking at the Ser energetic systems and uh did a lot of work with cats ultimately I could not do personally the animal work required of the sort of indentured servitude that I would I think you wrote someplace once you know you said you know when confronted

01:42:00 with the uh the prospect of um installing a a a computer printer into the head of ACK on the back of a cat head they they Lally had those like those little VGA ports on the back of these cats heads because cats sleep a lot and so they're interesting study a lot that cats very few Laboratories work on cats any longer it's mostly a mouse still some non-human primate work my lab is essentially shut down um or is in the process of shutting down even our Mouse work I much prefer to work on humans they can give consent

01:42:31 and they house themselves and um the animal research thing is tough for any for any sentient being yeah it's it's tough the cat for what it's worth the cats seem pretty happy like they were just sleeping I mean the the ports were for tracking so the cats were pretty I mean they were just normal cats the cats were fine but I would have been we would have been injecting retroviruses into rats and then perfusing them which means bleeding them to death uh to avoid bruising of the tissue because then if you're going to take

01:42:58 thin slices and scans you didn't want to have bruising and I just couldn't I just couldn't do it I think it's important I do think I do think there's a place for it but I couldn't do it so that's why I transferred out but the the point I was trying to make is that I had the experience and then I had that drive the scientific interest and then I had probably one experience per year for a few years after that and what I noticed for myself personally because I've suffered from major depressive disorder and extended depre

01:43:34 depressive episodes let's just say on average three to four a year and by by extended even before you had started even before from a young age yeah from a very young age and I would say so let's just call it three to four on average a year those could last each a few weeks or a few months I mean this is this is a a very high percentage of my total year and when I had these higher dose experiences with mushrooms so we're talking about COC mushrooms and then if we're looking at the molecule that's

01:44:03 being examined scientifically psilocybin I noticed this Afterglow effect that was really durable and that was an anti-depressant effect or a mood elevating effect that lasted far longer than the halflife could explain right because four to 6 hours you're you're you're kind of on the other side and I would experience this this Afterglow effect for 3 to six months and that raised all

sorts of interesting questions what the hell is going on here is it the content is it some structural change there were a lot of unanswered

01:44:38 questions for me and then I had a very very scary experience that led me to completely stop use of psychedelics where again uncontrolled environment ended up in rural uh in rural New York coming out of my trip standing in the middle of the road in the middle of the night with headlights coming at me goodness gracious so you don't want to do that yeah and I was like okay too dangerous were you taking them alone is that how that is I was taking them with two friends and my two friends without

01:45:06 telling me just went for a walk and left me alone points to the you know I mean there're these are powerful compounds yeah you're you're you're playing with nuclear power like these these are the this is the nuclear power of like psychological or uh psychoemotional surgery is is the way I encourage people to think about them and I stopped using any psychedelics completely I was still very interested in them and but I basically hit pause and I didn't revisit that until let's call it 2012 2013 where

01:45:44 I was still struggling with major depressive disorder and I saw my girlfriend at the time completely transformed by supervised facilitated use of in this case iasa which uh was not quite as common as it is in conversation at the time and she did that in South America but she not only explained her experience but I was able to see the transformation in her that seemed to have some durability over time and that is when I started stepping back into researching psychedelics looking at what had been published in the last

01:46:24 let's just call it 10 years uh as of that point in time and thinking about how I would approach it systematically with safeguards with proper supervision basically approaching it the way I would have approached any of the topics in the 4our body and that is what led me back into along with a number of other interventions I should say so I wasn't betting the farm on psychedelics I also started teach at that point I was I was just some people might uh trans uh transcendental these are like 4 to 10 day meditation Retreats

01:47:02 this was actually much shorter it was a two or three day training and you're visiting the instructor I want to say it's once or twice a day probably once a day and getting up to speed and I did this because I was going through an a period of acute stress this is finishing the 4our chef this is actually probably in the Years preceding that and I had one friend who I'd seen really change from let's just call hyper kinetic high anxiety to low anxiety and he said you have the time you have the money pay for

01:47:37 the course just take it yes there are all these criticisms of TM yes there are all these weird historical anecdotes of people trying to levitate and all this weirdness just ignore that I'm trying to levitate nothing against that if you actually levitate then we got to have a discussion but trying to levitate seems like why you know every kid every kid tries all sorts of things give it a go uh he's like just put that aside because I I kept coming up with push back and he's like look all I'm saying is it's

01:48:04 like a warm bath for your mind that you take twice a day and it'll chill you the out so try it and I was like okay fine it's a good endorsement I was like I was like at this point I was i' had been burning the candle at both ends so intensely it's like okay so there was TM and then I began examining how I might approach notice I didn't just jump into using them I was like how could I approach taking adelic in a sequence in a logical sequence with proper protections with safety assurances and that took

01:48:33 me probably a month or two and I was right in the middle of things in Northern California you have access to a lot and only then did I start looking at having my own experiences and lo and behold I mean I'll I'll cut to the chase but the the personal outcome and there there are many different benefits uh and risks I should make very clear these things can be extremely dangerous in certain ways generally not physiologically but they can be dangerous I would say instead of three to four times per year on average I

01:49:08 probably have one depressive episode every two years that's a significant improvement yeah right I mean from a quality of life perspective those are two different people and uh that then led me to and I as I did with all my workouts right I took copious notes over the span I mean now we're looking at 10 plus years uh so if I were to ever write another book uh it would probably be related to all of the really fine details of the experiments and my learnings including some of the more Biz bizarre things over the last 10

01:49:48 years but it would be a it would be just a beast to create so with with psychedelics experiences with psychedelics psychedelics and sort of psychedelic adjacent uh non-ordinary experiences of Consciousness uh which I think often are touching at edges of the same thing uh which which is going to be controversial for some folks but to to come back to the storyline just to put a bow on that when I saw the personal outcomes for me the anic data from friends who are facilitators who have worked with

01:50:25 thousands of people right which is a pretty good sample size still anecdote but these are people who are very smart who keep records and I I believe that these people have spotted patterns that are only going to be possible to test and verify over the next 5 to 10 years so I at least as a as a means of generating hypothesis I take these people very seriously uh and then I

started to connect with Scientists whose work I had read like Roland Griffith and John's Hopkins began looking at the most compelling data related to say MDMA

01:51:02 assistant Psychotherapy and complex PTSD I I made the commitment to myself that as soon as I had enough money to move the dial because I really felt like these tools were so outside of the normal Paradigm of Psychiatry and pharmacology and that made me very excited because it was uncrowded there's very little funding coming into the space it was high leverage and I looked at it just as I've looked at my many startup Investments uh limited downside risk really high upside potential and I should say before that I had already

01:51:39 been funding in a very small way science so the first check I ever wrote was personally to Adam gazali's Lab at UCSF yeah great lab which at the time was looking at soft Ware he's not going to like this description but I'm going to simplify it software that might attenuate or reverse age related cognitive impairment uh spe specifically related to various aspects of of attention and that was my first for into funding early stage science which was very analogous to me of uh to to funding early stage startups and then later on

01:52:19 to touch on the reputational thing I know this is a TED talk so thank you for listening no this is great please please you're always so gracious on your podcast this is what people want this is certainly what I want to hear so so on the reputational side you're right that at the time especially let's just call it 2013 to 2015 this was not a na a comfortable National conversation of any type yeah I wouldn't have had this conversation back then no way I'd lose I I don't know that I would have lost my

01:52:46 job it just would have raised a lot of eyebrows now that such studies are happening at Stanford the perception yeah the perception was these are a professional third rail at the very least right also illegal therefore if I talk about them am I giving someone probable cause am I going to get myself in some type of really tricky legal situation Etc there are a lot of considerations but I tested that just like I was saying I like to capture my assumptions on paper so I can stress this I was like okay I think that might

01:53:18 be true most people I know think that is true but is it true how could we test to see if that is true or not and I decided to crowdfund for a Hopkins pilot study looking at psilocybin for treatment resistant depression and I thought to myself okay we have we have a couple of couple of things falling in our favor here number one depression does not discriminate so cross soio economic classes across gender across race this is a problem almost everyone knows someone who takes anti-depressants who is still

01:53:55 depressed okay treatment resistant depression therefore is the indication siloc cybin is the intervention let me crowdfund and I did that throughout the time crowd rise which was co-founded by Edward Norton who had become a friend and was the actor Ed who's very smart very very very smart also one of the best investors I've ever met which a lot of people don't know very bright guy and so crowd funded and I also like to put my uh money where my mouth is so I said okay guys I'm going to seed this like I'm

01:54:30 putting in X the goal is to raise I think it was 880,000 something like that for the following study and then I was like let's see let's see what happens and there was basically zero negative blowback and Not only was there no discernable negative blowback a number of people and this was deliberate I wanted to see this a number of people came out of the woodwork to support in a bigger way and I was like oh okay I see you bunch a handful of folks I knew and I was like oh interesting okay there are at least a

01:55:01 half a dozen folks who are studying the same thing or paying attention to the same thing and then I just got Boulder I was like okay if I tested that let me push and then let's see what happens and I'll wait and lo and behold I realized that the perception did not match the reality the reality was if you're talking about IND indications that cause an incredible amount of suffering for a very large number of people even those who are anti-drug per se just say no to drugs want Solutions and the current treatments for many of

01:55:37 these things do not work very well and in the best of cases are often masking symptoms and not addressing root causes I would say so at that point I just went whole hog and I said okay look I like to think that I am exactly what you see is what you get right the person you talk to off camera person you talk to on camera same and if I start feeling like I have too much to protect I want to do something to counteract that in other words if if I feel like I need to censor my true feelings and beliefs

01:56:12 maybe not share my hardships perhaps not promote certain things because I have a reputation to lose that's a fragile position I want to be as antifragile as possible and so by talking about this I viewed it as a way of inoculating myself against fear of reputation loss like okay let me push this like I'll ride this horse other people might not but I wanted to remove the stigma for funding purposes hopefully open up federal funding that's starting to happen now from different agencies and then to focus on access and

01:56:47 reduction of cost and insurance reimbursement and so on so I set a game plan let's call it maybe five years ago and I've just been slowly methodically executing on that since and uh the reason I chose this to focus on and I've funded other things but I've really focused on this mental health Therapeutics which is not limited to psychedelics we could talk about some other

things that I find interesting but psychedelics are like I said what makes it attractive very uncrowded you can do a lot with a small amount of money

01:57:20 unlike saying cancer research can be very hard like okay you're Deca billionaire great maybe you can do something interesting and I'm sure other people could but if you have 20,000 \$50,000 it's going to be hard to make a dent there in psychedelics you can actually still make a difference and very high leverage in part because these compounds seem to challenge much of what we assume to be true about treating mental health and uh so that's uh that makes for an attractive bet so that's where I've been been going yeah I'm so glad

01:57:51 you shared that with us and that you did that exploration um and that you've been spearheading the funding efforts uh you know this podcast has a um a premium channel that's for raising funds for scientific studies we are in the process now making our first four uh contributions one of those includes uh work in Nolan Williams laboratory at Stanford combining trans cranial magnetic stimulation with um studies of ibigan and uh 5 Meo DMT maybe a few other things but basically that he's free to do what he wants with the funds

01:58:24 we trust him to do great work but that again was inspired by you right uh podcast with a scientific um slant certainly um this podcast obviously has a scientific slant but the idea of doing philanthropy for the sorts of work that uh really deserves funding and exploration and um by the way um and thinking about other hybrid things that would be fun to do I mean I would love to uh contribute and join those efforts that you cu the work to continue to raise funding for psychedelic studies and all these great Laboratories

01:58:59 continues right it continues and you've rallied a collection of um some pretty uh powerful people to contribute to this and I know you've joined arms with Michael Pollen in many ways do you want to talk about the fellowships that you guys put together I find that really cool you you've got fellowships uh in the works or maybe already happening at UC Berkeley is that right at UC Berkeley yeah so the what what I try to do and for people who want to check it out it's the name of the foundation is Cay

01:59:24 foundation and let me explain that for a second so it's S A II so Cay foundation.org I speak Japanese I went there as an exchange student and speak read and write it still to this day pretty well sa can mean a lot of things it means rebirth in Japanese and I've seen what can only be described or can certainly be described as rebirth and so many clinical outcomes that I thought it was appropriate to use and what I've tried to do with the foundation is I think do what I'm pretty good at which is trying to peek around corners

02:00:01 and find something to prototype right so just like the CGM and like all right how can I just getting a hold of a Dexcom back then when it was just for type 1 diabetics was was hard it was is the thing that you have to actually go under the skin so it's like taking a barbecue prong and putting it under your ab abdominal skin it was not comfortable can you describe your um cortisol level and uh subjective terms when you're at home you got this thing and you're about to implant it and you don't have any

02:00:29 precent it's not like this is you know like levels or one of these other uh cgms that are out there you know stamp the thing in you can look on Instagram and see someone else do it there's nothing like that so you're at home wondering if you're going to skew your liver yeah I I'm I'm at home doing it myself and I'm sweating like a stuck pig I'm sitting there I'm like my God I don't even know if I can hold is your girlfriend there like to support you in case you I think at the time wasn't because she was squeamish and didn't

02:00:53 want to see it and I'm so I'm sitting there at my kitchen table I remember this God I'm sweating just thinking about it and no videos to watch and uh wasn't really supposed to have it in the first place and uh the device for readout by the way no iPhone right so it's like this janky pager looking thing that had a readout that made you think you were playing pong or something I mean it was very the green the green tint screen yeah green tin screen do font it was so primitive and uh put this thing under my

02:01:29 skin would tape uh I would cut a Ziploc bag and put it on top and and masking tape it to my skin to take showers because otherwise it wouldn't work and it was it was great and I'll just say that I don't use a c it was great you realize you said it was great I did I did say it was great because sweating and it was I was afraid but it gave me a lot of insight okay and uh then once I had the Insight over a course of a handful of weeks then I felt like I didn't really need it anymore and that was also just a heavy tax to pay

02:02:01 to have to wear that thing around look like you have a you know what is it called a colostomy bag or something it just like it was big it was bulky um so just like I did that I wanted to do proof of concept right the goal was can I use this for healthy normal applications will the insights be actionable and they were lo and behold similarly with the foundation since I'm dealing with smaller amounts of money you know I'm not uh in the billionaire club by any stretch of the imagination and science

02:02:34 can be expensive I'm looking for small bets where can I pilot something that if successful will be emulated or can be scaled and so and say the crowdfunding for for the Hopkins treatment resistant depression pilot study we ended up exceeding the goal they were able to recruit more subjects in the case of UC Berkeley Michael poen and I partnered on this and my Foundation

funded it the ferris UC Berkeley journalism Fellowship psychedelic journalism Fellowship is providing funding to up-and-coming

02:03:08 journalists who want to focus on psychedelics as their beat which to this date has not been financially feasible you just don't have the space to do really long for investig investigative work the Hope being that these journalists can apply their skills and their dedication to examining different facets of the Psychedelic ecosystem therapeutic potential uh regulatory issues ETC in a way that can shape and inform National and international discourse in a in a very critical way because these things

02:03:51 are not a Panacea there's a lot of claims that are made about these that are totally unbacked by any type of Science and there're a lot of charlatans and so I want wanted to also invite really competent really good journalists to the table who might want to watch for Bad actors I think that's really important and so this Fellowship has been been uh has been awarding fellows with these grants and I think it's a relatively small amount of money it's like \$10,000 per something like that but the outcomes have been amazing we had a

02:04:25 huge I want to say was 7,000 word piece that was one of the main features in Rolling Stone magazine huge piece in National Geographic focused on iboga and fair trade and some of the implications for uh local harvesting and or over harvesting all the Dynamics present in that which I think has some incredible promise for particular forms of um opioid use opioid use disorder in particular but uh that has been a huge success so the hope is that other journalism schools will say that's a great idea and I will have DER risked it

02:05:03 for some other philanthropist or Foundation or government say director at an agency to say okay well green like that right because I've done it and it's been received very well and it's had a real impact on how things are moving along another one would be say at Harvard popper this is at Harvard Law School was the first is the first dedicated team focused on law policy and regulation related to psychedelics from a legal perspective super important super important super super important also another pilot let's just call it uh

02:05:39 proof of concept that Cay Foundation funded was helping to develop curricula for I think it was Yale John's Hopkins and NYU effectively an creditation or module that they could put into their existing Psychiatry MD uh programs such that people could develop the skills necessary and the understanding necessary to administer psychedelic assist therapies if and when they become legal prescribable which it if I understand correctly it sounds like within the next 12 to 24 months MDMA assisted Psychotherapy for the treatment

02:06:20 of trauma is is likely to become legal in the hands of uh psychiatrists at least and maybe certain clinical psychologists as well in the US is that right through the M through the efforts of the maps group yeah through through the efforts of maps.org and Rick dolbin and many others that is the tip of the spear so I think anyone who's interested in psychedelics should have a vested interest in supporting those efforts not because we know everything works I want to be clear not because we know a priori that all

02:06:55 these things do all the things no but if if MDMA fails it's going to be very hard to draft it'll be impossible to draft on that with commands that are more difficult to administer like psilocybin which would be next in line for alcohol use disorder also major depressive disorder so I I I really feel that just like everything I've talked about whether it's networking putting together the 4our body or trying to change National policy and say uh uh reclassification of these compounds getting them out of schedule one to some

02:07:35 extent you want to break it down into its constituent pieces you want to do an 8020 analysis figure out what the critical few are and then put them in a logical sequence and execute the plan one of the greatest weaknesses in the Psychedelic ecosystem is there are a lot of people who just want to do all the things and save all the people and the animals and all the places all at once and that just doesn't work very well there are also some really good people who are executing um and we could talk

02:07:59 about the for-profit side and so on but uh I've been very very very pleased with the outcomes that Cay Foundation has been able to achieve with very limited money I'm prouder of those outcomes than I am of the startup record and the startup record is pretty good um and it's the same lens I'm using the same the same filters and the same approach which uh which is kind of what I'm always looking for I'm looking for stuff that'll translate across Fields if possible and then you mentioned one like TMS I think TMS very interesting

02:08:32 transcranial magnetic stimulation yeah which at one point was um more commonly used to inhibit specific brain areas this is a non-invasive technique uh I've had it done where it's over my motor cortex and you're tapping your finger and all of a sudden you can't tap your fingers it's pretty eer but now it can be used to stimulate at particular frequencies enhance neuroplasticity and and in combin with psychedelics is the that's kind of the burning question now can you get a uh a synergistic effect of

02:08:58 TMS and and uh psychedelic maybe um not just during the the psilocybin or uh iboga Journey but in the days and weeks after when we know for sure a lot of plasticity is still occurring so keep the plasticity on board or accelerate it yeah yeah so T TMS uh also is a monotherapy very interesting to me for depression anxiety even substance use disorders super

interesting and there are many different protocols all sorts of different technology uh I would say low intensity or low power ultrasound also super

02:09:32 interesting uh for various various applications potentially to addiction so I'm not to be clear a card carrying evangelist for psychedelics I am a proponent of looking for high leverage on crowded Bets with limited downside and testing them out and very optimistic about psychedelics if anyone listening has a family history of say schizophrenia borderline personality disorder uh which we might which this is being very simplistic but categorize or describe as more chaotic conditions compared to hyper rigid conditions like an OCD or

02:10:20 anorexia nervosa uh chronic depression Etc and we can talk about why some of these psychedelics at least some of the classical psychedelics seem to have cross efficacy with multiple conditions but psychedelics seem very helpful for certain types of hyper rigidity when you get into schizophrenia borderline personality disorder they can be really heavily contraindicated not to say that they cause those cons those conditions but they can precipitate the onset of those symptoms and for that reason can

02:10:54 be very destabilizing and dangerous for for certain people however that's where something like metabolic Psychiatry comes in and the use of ketosis and the ketogenic diet which appears to be very effective in some patients for that grouping of say more chaotic conditions which is very exciting so I'm interested in in in any tools that are off the beaten path that seem to raise interesting questions that have not been answered in a satisfying way yet in medicine uh and I think we're still largely in the Dark Ages with respect to

02:11:33 Psychiatry oh I think um the best psychiatrists would agree with you yeah and and the best psychiatrists uh and the best scientists and the best fill in the blank are acutely aware of the limitations of our current methods and the limitations of our current knowledge uh so I think the mark of a good thinker the mark of a good scientist the mark of a good fill-in-theblank anything is someone who says I'd have no idea or we have no idea a lot and hopefully they also say let's go figure it out or try

02:12:06 some things and I I I really want to thank you for sharing um that narrative especially because it makes clear that you brought the same systematic process of using and asking excellent questions to arrive at Solutions to arrive at more questions to fund areas of inquiry and to do it all in this really structured way as you said from policy all the way down to like how many grams or uh you know X of of some substance somebody might take I mean I think Matthew Johnson's laboratory at Hopkins uh Roland Griffith uh Robin cardart Harris

02:12:43 at UCSF uh Nolan Williams the maps group Rick Dobkin Peter Hendrick at University of Alabama looking at cocaine addiction things yeah you Michael Pollen um you know I'm leaving some names out here and I don't want to take anything away from the um classic uh as they're called um explorers of psychedelics and writers about psychedelics but we are in the moment of a Renaissance now and it's important that this have a lot of uh fuel so we'll put a link to um your philanthropy efforts and and the

02:13:13 journalism uh fellowships as well because I think there's going to be a lot of interest there and I'm huge supporter of what you're doing as as you know and I just think it's the way great science and clinical progress is made so you um thanks Andrew yeah it's which brings me to another parallel topic you know it used to be that meditation and psychedelics were have nested in the same territory this would be in the late 60s early 70s the birth of places like Etc or the consequence of the

02:13:41 Dual exploration of those things meditation sort of escaped from the psychedelics umbrella and vice versa um starting sometime in the you know mid 2000s when neuroimaging became a little bit more accessible and you know I think nowadays if you told anybody okay um you know meditation is good for you it can help uh ratchet down your anxiety give more self-awareness um you know improve sleep and on and on maybe even give some insight into Consciousness no one's going to bulk there just a lot of studies there are thousands of studies

02:14:13 um my laboratory's done a few of them there are other Laboratories who have done uh far more the book altered traits is the one that comes to mind group out of Wisconsin was early to early to the game on this um in any event you talked about TM um I'm curious from a practical standpoint do you still meditate daily do you do meditation Retreats um what sorts of meditative practices do you have because I realize this can be done walking writing as its own form of meditation what sorts of formal practices do you still engage in now

02:14:46 yeah I do 10 to 20 minutes in the morning so I am not currently doing the TM twice daily 20 minutes I think that would be better for me probably do you set a clock and you or yeah I'll set a clock uh which would be more of the concentration practice of say a TM where you're repeating a mantra honestly it could be any in my opinion some TM purists will bulk at this but uh it could be really any nonsense syllable could be a word although I think something without any attached meaning is probably more beneficial for a host

02:15:16 of reasons so con could be a concentration practice with 20 minutes of sitting it might also be a guided meditation and I have no vested interest in this app but I think the waking up app by Sam Harris is fantastic I have do I I have used the introductory course which is Sam leading you through my catnip which is a logical progression of skill development from day one to three and

and forward I have gone through that course multiple times when I'm getting back on the horse for meditation as a bit of a reboot once you develop I think

02:15:51 a certain degree of awareness and mindfulness I do think there are other activities that probably allow you the parallel experience of doing one thing while experiencing some of the benefits of meditation and so for me I wonder at times are the benefits of meditation the concentration practice itself is it just sitting still with my eyes closed downregulating my system a little bit activating my Parasympathetic and not rushing or doing anything for 20 minutes is that it maybe is it simply correcting my posture for 20

02:16:32 minutes how do I wait these different inputs and the short answer is you probably don't need to know but I have found that spending time in silence in nature without anything to do disallowing myself from doing things no note take no reading Etc and spending I have spent a number of extended fasts in nature just like water only by myself no talking no reading no writing what's extended seven days generally wow so you're camping in nature MH with just water yep that's it by myself and there are risks associated

02:17:12 with that right you gotta be careful not stupid about it but uh that does a lot for me with some persistent benefits are there some favorite places that you've gone uh into nature it doesn't have to be too fast like for instance I'm a big fan of um some of the national parks up in the Pacific Northwest because it's like being transported to a different planet Y is obviously amazing but any favorite spots um where we won't go people won't go looking for you there don't worry yeah I you live in Austin

02:17:41 all the time so they right yeah so I would say uh Colorado Utah New Mexico spending time in mountains around River rivers lakes I find very therapeutic and just gorgeous I do think we suffer from uh awe deficiency disorder you know a bit of add when we're trapped in the mundane for too long with too much distraction with too many to-dos with too many relationships and there's no space for a there there isn't the room necessary a isn't from my perspective generally a quick hit that you get in the 30 seconds

02:18:22 between using two apps there's more Breathing Room required for a genuine Transcendent experience of awe so I try to on a yearly basis as one of my top priorities block out these weeks of time in nature yeah last year was the first year I did that I went out to Colorado um in August and just took daily hikes I stayed in a hotel was I'm not as beastly as you doing water fast I was eating every day but um it was spectacular one thing I noticed and I'd like to know your process on how do you

02:18:55 handle going back into life um great question you know because those days were and are amazing right you like detached and you know maybe one text message here or there in between hikes or something and then you just really clued in even the the process of watching a show at night like one felt so rich and like enough so I wasn't um as aesthetic as you were and uh like really cleaned all the Clutter but once you return to life mhm it's almost like get being a wash in demands and and I can see from a place of more Equanimity

02:19:26 how one could make better choices but how do you handle those transitions the re-entry yeah so before getting to the re-entry I think it might make sense for me to talk about what comes before so let's say it's like pre during post part of the reason I do these one week or longer periods Off the Grid is because it forces me to put better systems in place so there's the benefit that you derive from say that week and I have three weeks coming up right after this interview where I'm going to be off

02:20:00 the grid to set myself up for three weeks off the grid I have a team I have the podcast I have a lot of things that are in motion at any given point in time if you disappear for say a two to 4- we period generally you cannot let the whole house catch on fire then come back and put it out effectively which means you need put some policies and rules and so on in place in advance and there's a carryover effect that has a host of benefits and makes things smoother for the re-entry so they're related like the

02:20:32 more you set up the pre the easier the post is going to be and then you have this beautiful expansive experience in nature whatever it might be whether you're making it a sufferfest like I do or at a hotel at night either way these things can work and nature in and of itself is super helpful I do think that a lot of the time we like to imagine because we're driven smart accomplished people that our problems are very complex and at the end of the day it's like you just need some time in nature and a cold shower and some

02:21:06 macadamia nuts and you'll be fine you don't need to solve like all the existential dilemmas of humankind actually or fancy Pharmaceuticals so you have this experience over this week and what I will do then is set at least a let's call it integration period of two to three days where I will slowly Edge back in to my previous routine I will not within 12 hours of getting back to so-called civilization have a day full of calls or meetings I will not do that it's too much of a shock to the system and I think it robs you of a tail

02:21:44 end of benefits which would also be the case with say fast or ketogenic diet or any number of interventions you can squeeze out a longtail of benefits if you make a handful of changes for instance after an extended fast what if you started with a subc caloric ketogenic diet for a few days you get to extend some of the benefits as opposed to going straight back to say a diet that

includes a lot of carbohydrates similarly when you create more of a vacuum more space for awe
Insight reflection recovery I I think you're doing yourself

02:22:21 a disservice if you jump from park into sixth gear and so I plan for that and it's a function of scheduling I also have a predictable weekly schedule so I tend to schedule podcast recordings on Mondays and Fridays in preparation for an extended trip I will batch a lot of similar activities that we have say a bunch of episodes in the bank that are prescheduled everything is figured out in advance and over time the more you take these breaks the better your systems become and the more liberated you are from the day-to-day which means

02:22:56 when you get back you also don't need to rush as much into hyperactivity and if you do you know that that is more from a compulsion than from a necessity while you on these nature Retreats are you writing on a daily basis are you just thinking and allowing thoughts to enter and leave your system depends on the retreat so sometimes I'm writing but writing I think can underscore for me a desire to be compulsively productive and I think that is inversely correlated to my happiness or sense of well-being a lot of the time so there

02:23:38 are many areas in my life now so if you were to ask me like what has changed significantly since the time that you wrote for our body I would say that rather than looking for areas to optimize I am looking where I can very deliberately de optimize certain areas to increase sense of well-being where can I de optimize where can I stop measuring where can I stop reading books which areas can I ignore completely what types of information can I just excise from my life altogether for a period of time delete Twitter stop reading about

02:24:14 books in X related to say AI or whatever it might be like where can I de optimize selectively to sort of optimize the whole does that make sense makes good sense yeah and before we started recording I gave you a book which is a short collection of poetry by uh haliza Gori which is called gold it's a collection of roomy poetry reading poetry is an activity almost by definition which is is the antithesis of optimization so I've tried to also integrate more of those activities into my life and this

02:24:50 relates to your question because there are times when I will just force myself to sit on my goddamn hands and not write not read just do the thing that is so uncomfortable sometimes which is just sitting there with yourself you know it can be incredibly uncomfortable and in part because of the fear that it could become comfortable yeah right especially for proactive people with a yeah strong to use Paul K's words generative drive you know you're going to that's a uh you know the which is a good thing uh I believe it's

02:25:25 a good thing and it it can be a good thing it can indicate really incredible adaptations it can also sometimes I think indicate Mal adaptations right and so I think it's it's helpful to take a break from that generative drive or at least just put it in park position to see if that generative Drive is perhaps indicative of you leaning towards something in a healthy proactive way versus running from something in a long-term destructive way yeah well and I think Paul would say that part of the generative Drive process is um Peace you

02:26:11 know not as necessarily even as a still state but as a um you know being able to experience peace even in the Transitions and there's a lot more to say about that and would say it far better than I ever would so I'll uh leave it at that and um I mean for people who have the option getting in nature it doesn't have to be all day every day on a water fast I just take certain things to an extreme because that's who I am but sorry when you say water fast that means fasting with water right it just fasting but yes

02:26:39 drinking water it just means you're allowed to have water and nothing else for for a long time I thought it meant that you're not drinking water oh yeah no don't do that some people do that right they do these crazy food water fasts um as a weight I think they believe it clears senent cells or something but um probably clears a lot more than just cocin cells yeah I uh there might be something to it I mean look there are people who recycle by drinking their own urine not my jam uh but I would say it's like three hours

02:27:07 without shelter three days without water three weeks without food general rule of thumb so be careful with dehydration you can go a long time without food if you have I don't care how ripped you are you get 8% body fat man you got plenty of time you can go couple weeks no problem you got calories St 9000 calories per pound stored body fat you got plenty don't worry uh so for people who have the option to be in nature and just exercise several hours a day to exhaustion see how many of your problems

02:27:40 seem to just go away just try that yeah well my Sunday routine uh is to try and get outside and move as much as possible yeah I don't always succeed but um I'm going to try a longer retreat into nature I think um Olympic National Forest is is calling me again it seems like once a year I just want to get back up there it's uh it's calling you you should get back out there it's spectacular I have a question about mentors I'm a big believer in mentors either uh mentors that know us and we know them or U people that we assign as

02:28:15 mentors without them realizing it um this sort of thing uh do you have mentors at this stage of life um for particular areas of life are you uh you mentoring yourself are you flying with um a few voices in your head uh that serve you well who are your mentors I definitely have people I consider mentors it's I think at this point rarely one way in the sense that they tend to be friends I

spend time with they get something from it I get something from it not in a transactional way but they find it fun or beneficial or amusing in

02:28:58 some way redeeming to spend time with me that's the hope but how is that different from like traditional friendship you know just sort of standard friendship are you focus are you spending time with some orientation toward like their embodying areas of life that you would like to emulate totally I mean I spend I spend time around people I hope to be more like in some way because guess what you're going to average into say the the sum holistic ho of the five or six people you spend the most time with so

02:29:34 you should choose that very carefully that includes virtual parasocial relationships like okay if you're listening to fill in- the blank person for four hours a week five hours a week two hours a week whoever that group is comprised of is going to influence who you become come and for me then I think carefully about my friendships and they could be older like a Kevin Kelly who's become a good friend who has a wealth of life experience that I don't have and so I might just call him and say Kevin I have

02:30:08 question for you but I do that with my younger friends too and they could be younger than I am and I might still view them as a mentor in xwi Z I think Mentor has a heavy weight to it it has a connotation of maybe NeverEnding time consuming obligation so I I would never for instance and I know a lot of people try this ask someone to be my mentor it's like would you like to be my free life coach forever you know it's like that's kind of how it sounds to the recipient it it sounds very formal yeah it sounds

02:30:40 very formal and so for me I would say there have certainly been mentors I've had wrestling coaches I've had teachers I've had resident advisor who were reverence who had a huge impact on my life and followed up with me and paid attention to me and cared for me in more of a one directional sense right I I view myself as the beneficiary of course they they certainly got something out of it if they had that job I they probably found it to be very gratifying in its own way and teachers like Professor Ed sha at

02:31:13 Princeton I feel in incredibly indebted to these days and for a long time I've believed that you can learn something powerful from almost anyone probably anyone you interact with could be an Uber driver could be someone taking garbage out of a restaurant if you really take the time to dig you can find something and before you can I think as an adult effectively think about who you would like to learn from if I put it that way it's helpful to have a baseline of self-awareness that you know what you

02:31:55 might want to work on to either amplify strengths develop skills address weaknesses and so for instance one of my close friends Matt mullenweg is younger than I am he's the he's the founder of automatic which runs wordpress.com he was the leite developer of Wordpress although was an open source project of course with many many contributors he was one of the lead developers Now power something like 32% of the internet and he exemplifies a cool and calm temperament even in the most chaotic periods imaginable during the most

02:32:33 chaotic events imaginable and when I find myself getting disregulated to use a fancy term losing my or getting carried away by emotion getting righteously angry or whatever it might be and I recognize at some some point that it's really not serving me that I am being owned by the emotion right like I'm the dog on the leash not the other way around then I think of Matt I'm like what would Matt do what advice would Matt give me right now how would Matt act in these circumstances and I do that with with many friends I

02:33:12 also think a lot about and this is borrowing from someone named Kathy Sierra a long time ago focusing more on just in time information as opposed to just in case information so just in case information is like I'm going to read these 20 books because in two years I might be interested in X Y and Z that I think is often a waste of time because if it ever becomes relevant you're just going to have to reread those books people do the same thing with humans they're like I want to meet so and so and have them as my mentor because maybe

02:33:45 five years from now I'll do X Y and Z and then they'll be useful for ABC that's too speculative and I think it ends up in a lot of wasted energy so the podcast for me writing the books and doing the interviews even prior to the podcast becoming involved with startups delving into the world of science and scientists all helps me to develop a confidence that almost any question I could ask I can find some semblance of an answer for by just reaching out to a few people and saying who do you know who might be able to answer

02:34:24 this and that's very reassuring and it it relieves some of the anxiety or pressure that people might feel to assemble some personal board of directors of like X-Men and women who can help them with everything uh and and then there are people I hire to be accountable to right so I might work with coaches therapists and so on who I would view as they just Happ to get getting paid for it right yeah the reason I asked the question is because we were talking about the meditative process going into nature and even with

02:34:58 psychedelics there you know they can be viewed a lot of different ways but I think of them largely as going inward to explore I mean you're out in nature and learning from nature um there's such a core truth to Nature I know that sounds a little bit you know uh wishy-washy but it's uh it's true like if it's there it's concrete it's really something uh it was there long before any of us and

it'll be there a lot longer than any of us will ever be we hope um uh certainly if it goes we go so um but the process

02:35:34 of learning from others and paying attention to others is is really an outward-looking thing I mean we have to bring that in but I was just curious how you balance those and as a way to really understand not just your time allocation right I think uh we could talk about that you know what's how's your morning structured Etc which I think there's Great Value in in knowing but more um what what's your mind allocation right I think about this you know like where's my brain is it am I focus on what's

02:36:00 going on in here and you know is that is there a need to excavate there sure you know but how much time am my out of my head and bringing things in from the outside world and back and forth so do you have some sense of um across the year across the day how you mind allocate I don't know if um that's the best phrase but I can't think of any better one if you can think of a better one please please uh table it cuz I I'm happy to to use that how do I think about mind allocation or attention [Music]

02:36:31 allocation I try to and most frequently think of my mind share across a year and across week a weekly time frame and I find that to be manageable in the sense that on a yearly basis on New Year's Eve or roughly around New Year's every year I'll do a past year review pyr past year review where I'll go back and I'll look at my entire last year have a piece of paper in front of me line down the center plus negative and I will go through every week in my calendar for the pre previous year and I will write down the people

02:37:24 places activities commitments Etc that produced Peak positive emotional experiences so right we're doing an 8020 analysis here like what are the big rocks that really move the needle in a meaningful way and conversely who are the people what are the things what are the places that just made me go g and we're draining produced Peak negative experiences why the hell did I commit to this type experiences and that presents me with a do more of do less of list then I look forward to the next year and I did this

02:38:02 I suppose just a handful of months ago around New Year's with the Positive I'm like okay here's my list of do more of it's not real until it's in the calendar let's get these things in the calendar and then I will start talking to people booking things having people help with organizing if that is qu ired and getting things blocked out so I have already this year and we're in the reasonable beginning stages of the year I have things blocked out until November of this year and those provide the breaks in the action not just the breaks

02:38:37 in the action but the fun stuff because by the way guys I thought for a long time like yeah you take care of ab andc and the good stuff just takes care of itself I have I do not any longer believe that to be true unless you schedule these things that you claim are important they're going to get crowded out by and maybe not but just less important things the Urgent will crush the important so I get these things on the calendar and then I back up and I look at optimal weekly mind allocation right attentional

02:39:12 allocation and there's a there's there's an Incredible cost to cognitive switching if you're just test switching all day so I will try my best to format a weekly Rhythm a weekly sequence that allows me to focus on certain types of tasks so Monday is very frequently admin of some type just bits and ends flats and jets them all the miscellaneous pieces that are part of life you got to deal with them that tends to be Monday whenever possible and especially if I am focused on physical activity let's just

02:39:52 say um in a place like Colorado I will try to schedule most of that for after lunch to ensure that I get in a lot of exercise and movement in the first portion of the day not everybody has that ability but I will say more of you have that capacity than you might think because most of what we all do is just not important yeah time on social media first thing in the morning is probably the most poisonous activity that I could take part in I don't want to you know point fingers at anyone else but oh yeah

02:40:26 I think if people ask you know what is the you know amount of time it takes to get in a really good workout it's going to be about an hour you know but a lot can be done in 45 or even 30 minutes you think about how quickly that time goes by on social media like I'm sure I'm not the only one uh that this part of the reason I deleted a lot of these apps from my phone it's like I would be I'd go into the bathroom to take a you know quick bit of business and then 45 minutes later I'm like how have I been

02:40:55 looking at Instagram 45 minutes yeah lines in for restrooms have gotten very long in the last 10 10 years has anyone noticed that the wait for the restrooms has gotten very long so you have time for the important stuff it's like and and just look at some of the extreme over cheers out there they have the same amount of time that you do have you I was gonna ask this later about just we'll just quickly interject this now um I saw perhaps it was on Twitter maybe I overheard this that you're back on

02:41:22 Instagram it's uh I mean you've always had an account yeah that posts but are you back in there are you out of there um I mean look my the Dirty Little Secret I'm single again and that's a great way to connect with with eligible ladies who might be of interest is Instagram so you're on um so you're on Instagram I'm willing to pay the tax of dealing with the brain damage of using

Instagram as a result hey look finding a great life partner is exactly EXA exactly so that's that is the reason for that but otherwise it would not be on my

02:41:58 phone it's too it wouldn't even be on your phone absolutely not it's too well designed these companies are very smart they have very good data scientists they have very good UI Specialists if anyone out there thinks that they can look maybe maybe Joo can can discipline his way through it I'm sure he can because he's he is Joo but in my case and in the case of most people like you're bringing a knife to gunfight if you think you can use your self-control to keep your use of Instagram to say 10 minutes at a clip

02:42:27 good luck yeah and even if you can people say ah but I do that anyway I'm like all right how much time do you spend sending memes and links from Instagram or fill-in the blank platform to your friends and group chat how much time does that consume I spend a fair amount of time on Instagram and Twitter posting things related to the podcast but um I don't have someone to do that for me and I I actually enjoy doing it and it challenges me in certain ways but I completely agree with everything you're saying I also want to note that

02:42:54 you didn't say that you're on Twitter uh possibly to meet somebody um which is more a statement about Twitter yeah yeah it's not the it's not the not the friendliest neighborhood I've found and uh I would say Twitter has its use cases I I find it useful in some respects it has become much less useful and much less practical in the last year with a lot of the product changes but it has its place it's not on my phone it was on my phone for a very brief period of time I do not want I find that my

02:43:26 ability to be still and calm is eroded if I am too easily able to escape boredom if you cease to have the ability to be bored for 5 to 10 minutes I think that makes you very fragile it makes you very easy to manipulate also and there are a lot of forces at play online that want to manipulate or shape your behavior in different ways so I feel like it is imperative for me to cultivate the ability to just sit still and not consume the five minutes in line waiting to get into a restaurant by hopping on Twitter or

02:44:09 Instagram so that's part of the reason they're not on my phone could you tell us about punch yeah I can tell you about punch so punch is a creative project intended once again to make me less precious about protecting whatever brand I think I might have and this is an investment in my long-term mental health also and I think in my career flexibility my willingness to experiment punch could be a long story but the gist of it is I wanted to experiment with fiction writing I been saying this for years and I've never

02:44:51 done it that's the backdrop on top of that I have wanted to get back into illustration and work in the visual arts which I did for a long time when I was younger and I've not done that consistent why not because I haven't had accountability I haven't had deadlines it hasn't been in the calendar this should sound somewhat familiar by now and at the same time I was becoming very interested in web 3 and what was happening in the world of nfts this is probably 2020 and I know they've developed a fairly negative connotation

02:45:25 for a lot of good reasons but I started to think about fundraising for early stage science and if I could do if I could conduct an experiment as a proof of concept with different novel approaches to fundraising so rather than just calling the rich friends who might sort of Bend to the pressure or be willing to fund I wanted to look at say crowdfunding back in the day then I wanted to look at different options for perhaps art auctions and I was going to do this with Contemporary Art this is many years ago and in the

02:46:04 process of wanting to fund the Hopkins Center focused on psychedelic and Consciousness research which was the first of its kind in the United States and the technology gave me the opportunity to learn about a new let's just call it set of Technologies so to develop skills and knowledge it would give me the opportunity to reconnect and deepen friendships with a number of my very very smart friends who are playing in that area also test fundraising also get back into fiction and art and all of that

02:46:39 combined into this thing that I end up calling punch because it made me laugh and you know what man if you take your work too seriously you're going to burn out before you get the really serious work done and I think it was uh berand Russell who said it's a sure sign of an impending nervous breakdown if you start taking your work too seriously or believing your work to be very very serious and for that reason I wanted to give it an absurd name that would also have some Word of Mouth benefit and that

02:47:14 to see what would happen honestly just see what would happen because someone like all right look what is honestly the worst thing that happens like people write a bunch of pieces where they're like shaking their fist at the sky how dare Tim Ferris Co create a project called punch you could turn it around on them and just say that what they were doing is a punch no well attempting attemp that well that was kind of the thing uh that was kind of part of the thinking that it would just be entertaining to watch people

02:47:40 seriously trying to critique something called punch and uh the upshot of that is it raised almost \$2 million sold out out in something like 30 minutes or 40 minutes for the foundation all that money went to cam Foundation all that money has already been distributed in the form of Grants wonderful and uh along the way I got to work with artists with programmers learn new

technologies reconnect with old friends and now we're back in touch and it's it's extremely fun to be back in touch with these folks and I've written the

02:48:17 equivalent of a short book in fiction in the form of short stories that are this Fantasy World building exercise for me and I'm having a blast so I'm exercising new creative muscles that has led me back into the worlds of comic books which I haven't created yet led me back into the worlds of gaming led me back into my fascination with tabletop gaming because I played D and D forever when I was a kid that was my refuge as a runt who got the crap kicked out of him left and right and I having just a blast and

02:48:48 the the takeaway I think on some level is that you should do things should is should is a is a is a loaded term it's helpful for me to consider doing things that give me energy right because if we say all right time management is fine but time doesn't really have any practical value unless you have attention right so then there's attentional management but that attention is limited also phys physically and sort of metaphorically by energy right so you have like substrates diets neurotransmitters and so on if you

02:49:27 do not have the the basic batteries required the rest of the things that are higher up on that pyramid can't really be executed properly so for me it's like okay let's say cockp punch doesn't do anything it's total failure right coming back to like it already raised \$2 million for Science and that science could be breakthrough science so so punch sorry I yelled sorry so punch is at least thus far a success it is but coming back to Seth Gooden's question I asked myself would I do this even if it

02:50:01 turns out to be a complete failure financially and I was like yes because I think the relationships and the skills even if this quote unquote fails from the outside looking in those will transcend this project and be life affirming and helpful and fun in other areas and that's proven to be true even though the project is ongoing and I have more energy now because of this ridiculous project I'm very proud of the fiction actually this ridiculous project called punch people can find the legend of punch on uh any

02:50:35 fine provider of podcasts and hired voice actors did the scripting the production I it hit number one fiction worldwide on Apple podcast for a while the whole thing's hilarious and um and if you could could you explain a little bit about the characters in Punch Yeah I gu who's who's punching who's yeah yeah or which are punching yeah which are punching which how does this work so here we go all right so Co The Legend Of punch takes place in this realm called varata and verata is being described through

02:51:10 the narrator who we know as the seventh scribe we don't know much about the seventh scribe but the seventh scribe makes an appearance in episode one as the reliable but possibly sometimes unreliable narrator of this space and there's a there's a mind-bending Time component where there's something called restarts something like the edge of tomorrow if people have ever seen this movie where time restarts maybe like Groundhog Day time restarts and it's unclear as of yet in the story why that is the case but

02:51:38 people basically snap into being they know who they are and what they do but they have no real memories to speak of so the world is constantly being constructed and pieced together by these scribes the seventh of which is the narrator so you can you might read into this that I am a fan of fantasy tolken you name it URS Ursula kwinn the wizard of earthy Etc then there are eight primary houses these are the greater houses some might call them Clans and they have different characteristics just prior to this

02:52:15 seventh scribe beginning his piecing together which turns into this story in the podcast there was a Waring States period this much he's been able to establish and the peacekeeping mechanism that was devised is something called the great games and the great games is a combat competition and the eight greater houses send their best fighters who've been vetted through preliminary competitions to the great games which is in the free trade zone which is this one place where all of the races mingle and trade and so

02:52:49 on and all these characters happen to be anthropomorphized roosters so they have uh generally each one Gauntlet of some type and clearly they punch each other with this Gauntlet and they're many other types of weapons so the colloquial nickname for this Olympics of combat is punch and that is the that is the etymology uh so the scholars say of punch The Legend Of punch and there's a lot more to it and there are many wrinkles a lot of Easter eggs in this entire story the idea came to me and it started off as a bit of a farce

02:53:28 right it was just going to be something funny see if it works maybe it raises some money very light lift but once I got into the fiction I started taking it super seriously so it's become very very elaborate it's become really really elaborate and I'm loving it it's great so who knows where it'll go I have no idea that's part of the reason why I called it an emergent long fiction project I didn't call it an nft project I was like this is an emergent long fiction project where I'm taking inputs from the audience I'm I'm watching very

02:53:59 closely what people understand or don't understand or find interesting I'm looking at for instance what is generated when I host an AI assisted art competition which I did with the fans and a lot of these bits and pieces get integrated in some fashion into this thing that chapter by chapter is coalescing so that's cockpunch amazing and I had to buy cockpunch.com in the at

cockpunch Twitter you had to buy it from somebody oh yeah oh yeah oh yeah the whole process I don't want to ask what it was

02:54:32 being used for prior to your purchasing it was not being used for uh Fantasy World building I'll put it that way got it amazing and for so many reasons I have so much to say about first of all your excitement about it is tangible yeah the energy you have around it is infectious um and while I don't want to go into the total um depth and Contour of uh what Paul kti has been telling me over the last week of preparing this mental health series about what's really great in life that we all should cultivate it has a lot to do with this

02:55:07 generative Drive which has a lot to do with positive energy not just positive thinking but positive energy but this um this Triad of Peace contentment and delight and as you were explaining it it's clear that it brings you great peace contentment and Delight as action terms not like sit there and just hover in the Basking in it it's just so clear that this was a great idea um and I love that you started it as a way to kind of um uh I don't know like knock the fear out of yourself a little bit by knocking

02:55:39 a little fear into the whole thing yeah like like what would happen if you let your mind go and and allowed yourself to explore this and and what permission would it by you if it's not a total disaster this is true for the 4-Hour Body too I'm like what if this partially works it's not even a home run but let's say I get on Bas what permission does this then buy me what other Impossibles in quotation marks am I willing to challenge and I was able to make the Hop from one category in the bookstore to a

02:56:09 completely different category and then the sky's limit I was like I can do anything I can do whatever I want I've given myself permission and the market has given me permission but the most important first is you giving yourself permission and with say punch as ludicrous as it is now that I've done that my career hasn't ended hasn't had any negative impact on my career whatsoever I'm like okay that's actually kind of surprising to the contrary it seems like it gives you energy raised money for science is

02:56:39 it still raising money is there still an opportunity for people to No it's contri it's sold out um if people want to contribute to to say the early stage science and let's just say specifically psychedelics I would say it's very very hard to get a very solid understanding of the field and the shifting Sands and the projects and so on it's it's very rapidly changing so I would say just provide money to a foundation that's already doing good work it could be riversticks Foundation it could be Beckley

02:57:15 Foundation my Foundation Cay Foundation I think does pretty good work and Cay is not just the Jour uh the journalism fellowships they're also the it's funding for psychedelics oh there's tons of stuff there's a project page on Cay foundation.org you can see the projects they're probably 15 to 20 of them and they can see the basic science all the way from really basic science looking at possible mechanisms of action for something like dip which is a very strange compound that D yeah most people aren't going to know it that that

02:57:47 produces profound auditory distortions and hallucinations in humans very hard to animal model and from that all the way up to really sophisticated Imaging studies from that to say at least a year or two ago supporting phase three trials for MDMA assisted Psychotherapy then the journalism then the this then the that but a lot of a lot of different uh scientific studies that are that are being supported so that's that's very exciting to me and but the the cockpunch side of things is all done Money's been distributed uh

02:58:24 and maybe I'll do more of this kind of thing but I I might take a different approach I I feel like okay I learned what I feel I wanted to learn from that and maybe I'll try something new next time one thing's clear nobody tells you what to do um except you and but that's vetted through many important filters like structured filters and um very thoughtful filters are the words that come to mind when I think about yeah your process as you're sharing I one more thing which is one of the sources of Joy Of

02:59:01 punch is that it is not over planned I set some initial conditions and now it's emerging and as someone who has hyper analyzed and meticulously planned most of my life for decades I think it's helpful to have an improv component so if you are a hyper planner if you're a hyper measurer if you like that degree of control maybe you should try something that's a little less controlled take an improv class try fiction writing do something that isn't totally scripted where you don't know the outcome I think it's really good

02:59:40 medicine for people just like if you spend all your time in a yoga class maybe you should spend one day a week lifting weights see what that's like and if you spend all your time in the gym and you can barely touch your toes maybe you should do some more downward dog try some yoga similar I think the spectrum of hyper planned to completely free flowing and improv provides ample opportunity to uh enrich themselves and maybe address some weaknesses at the same time so for me punch has been incredibly

03:00:12 therapeutic probably the first time that anyone has ever uttered that sentence but yes probably yeah but that's part of what makes it so cool yeah totally I love it I'm wondering if you'd be willing to share with us a little bit about your mindset um maybe even your motivation but um certainly your mindset around sharing some of the hard personal tribulations that you shared uh in

preparation for this discussion today I went back to some of those posts that you did and the um podcasts that you did

03:00:47 around this and um I listen to them at the time and um you know they deal with quite serious violations of childhood and of self and um they're hard I mean they're they're hard to listen to and I can only imagine they must be even far far harder to experience and I was curious what led to your willingness to do that and um yeah I mean I have my own ideas about what might have motivated it but I'd like to hear it from you sure happy to talk about it uh and I think there are two particular examples that come to

03:01:26 mind so one is my near suicide in college and uh if people search some practical thoughts on suicide and my name it'll pop right up I mean if you just search my name and suicide it'll probably pop right up pretty well indexed at this point which is very deliberate people can look at the URL structure for a little wink and uh hat tip uh it'll tell you something about optimizing for Google if you look at it I'll just tell you the URL is spells out how to commit suicide but clearly I'm not teaching people how to commit

03:02:04 suicide but I wanted that to be a Honeypot for some of that traffic uh because it's a lot easier now to find that type of practical implementation advice and it's a bit harder to find I think compelling vention so first of all if you're feeling suicide obviously call Suicide Hotline please right uh that's sometimes the last thing that people want to hear when they are in a place of suicidal ideation and the reason I ended up writing a long post about this which was terrifying to write because I had never

03:02:40 told my parents I had never told my closest friends this was a secret this is a dark dark secret and I wrote about it because I went to an event in San Francisco I was interviewed on stage by Jason calanis who's a friend and a very good interviewer at an event and after I got off stage a bunch of people approached me and I was saying hi and taking photos and signing things and so on and there was one young man there very well-dressed uh which isn't really relevant I just it was striking cuz in San Francisco sometimes people are very

03:03:23 underdressed and he was he had dressed up for it like he' taken it seriously and he was in a suit and tie and he asked me if I could sign a book for his brother and I said sure no problem and I asked him what would you like me to write to your brother and he kind of blanked he didn't kind of blank he totally blanked but the look behind his eyes was unusual it wasn't just I don't know what to say blank there was something else behind it and I could tell that he felt under pressure and I said no problem take your

03:03:55 time I tell you what I'll just chat with a couple of other people and I'll sign the book no problem I'm not going anywhere and chatted with the other folks and then he asked if he could just walk me to the elevator and then I could sign the book I was like sure and he explained to me as I walked to the elevator how his brother had been a huge fan of mine and that I'd really kept his brother afloat for a long time and eventually his brother killed himself and that they' kept his room exactly how it was and he

03:04:32 wanted me to sign the book so that he could put the book in his brother's room and he asked me if I'd ever considered talking about mental health and mental health challenges publicly because he thought it would really help a lot of people and that just I mean I'm like feeling myself tear up right now I mean it's it it was so crushing to hear the story and totally unbeknownst to him I had a lot of history with depressive episodes and when I say near suicide I had it on the calendar I had a plan I

03:05:09 was going to kill myself I knew exactly how I was going to do it I knew where I was going to do it I knew all of the variables that I needed to account for to get it done and and the only reason that didn't happen for people who don't have the contacts which most people W is I had tried to reserve a book at Firestone Library this is at Princeton which had something to do with suicide it was like assisted suicide like the the clinicians guide to euthanasia something like that and it wasn't in and I had forgotten to change my

03:05:43 address at the register office I was taking a year away from school and that was to focus on finishing my thesis it was to try a few jobs but ID ended up in a very bad place and was feeling very isolated and my friends were graduating a year ahead of me and I was stuck on this thesis and there's a lot of backstory that I won't bore people with but it got to the point where I decided not that objectively objectively my life is bad I think this is where people who haven't experienced depression get a little confused or it's

03:06:14 hard for them to identify when they give advice to a depressed person because you might say to a depressed person like but look your life is so great like there's this there's that there's this and for a lot of depressed people to say yeah I know I look at that and I can't fix my state because I am broken and if this is how I'm going to have to live forever with being this broken and dysfunctional and to have this internal hell that I live day by day I just want to escape it's like someone jumping out of a burning

03:06:46 building it's like they don't want to kill themselves but they're jumping out of a burning building and so I had it on the calendar and thank God this was back when they would still send you a physical reminder in the mail a little postcard that says your book is in and that card went to my parents house and my mom saw it and panicked and called me and I lied I said it was for

a friend who went to Rutgers who was doing a project on AB andc but it's it was just enough to kind of snap me out of the trance and realize that

03:07:19 killing yourself is like putting on a suicide vest with explosives and walking into a room of all the people you care the most about and and blowing yourself up so that snapped me out of it but no one knew this this guy certainly didn't know that and that is when I went home and thought about it and just decided okay there's a chance if I write this it's not certain but there's a chance that this might help someone it might prevent someone from doing what I was almost about to do and so I spent months getting this

03:07:56 post written and put it out and I and I know for a fact it has saved minimum dozens of lives and there are other things including a very extensive list of resources and uh so that gave me I suppose uh not a toe in the water but sort of jumping feet first into the deep end and experience of being that vulnerable and this was a long time ago I mean this is I want to say at least eight to 10 years ago when I put that post out and uh then uh I want to say it was just before covid lockdown I was in Costa Rica visiting a

03:08:42 friend I was with my girlfriend at the time and she knew a secret of mine and she was one of maybe two or three people who knew that i' had been sexually abused when I was a kid by babysitter's son from 2 to four roughly and routinely all the time kind of thing and like what you're envisioning is is is is what happens so it was not good and that had been compartmentalized and locked away for my whole life I was like that's in the past we're Focus on moving forward and uh nothing to be fixed nothing to fix and that was my my

03:09:26 perspective on things uh it turned out wasn't quite that simple right and so I had done a lot of work a lot of therapy used psychedelic assist therapies as well uh which once again are not all upside potential there are some significant risks but I had come a long way and my plan had always been to wait until my parents passed because I didn't want them to blame themselves for this and then to write a book and there was something though at the time when I was having dinner with my girlfriend that was dissatisfying about

03:10:06 that plan it there's something about it that bothered me and I couldn't quite put a finger on it and I was talking to her about it and she said that's going to take a long time she's like have you ever thought about how many people people are going to pass away or die or suffer between now and when you publish that book and uh I thought about it and it was at that dinner that I decided to at least record a podcast covering this terrain I was not at all convinced that I wanted to publish it ||| I was terrified of

03:10:45 publishing it also because it meant open myself up to a lot of conversations or maybe just uh hurtful commentary online who knows like people are there are a lot of idiots out there and a lot of otherwise fine people who are idiots on the internet so it's very hesitant ultimately decided I I didn't want to do it as a oneman show I didn't want to make it a monologue so I asked my friend Debbie milman who had been on my podcast she's amazing graphic designer and teacher but she had unexpectedly on my

03:11:22 podcast based on some of my questions for the first time publicly told her story about being sexually abused and so I had leaned on her in years after that in private and I asked her if she'd be willing to have a conversation with me about our respective Journeys and what it felt like what it looked like what helped what didn't help what worked what didn't to provide at the very least a glimmer of hope for people who were keeping some of these dark secrets or contending with them not knowing what to do with them and we had

03:12:00 that conversation and I sat on it I sat on it I sat on it and then I put it out and decided in advance that I would not look at any social media for at least several weeks afterwards if my team saw anything on social media or got email I didn't want to see anything other than positive feedback which is not my deao I I'm usually eager to solicit constructive feedback but in this case I I knew that my own position was too vulnerable I I I didn't want to open up the possibility of of destabilizing

03:12:42 myself and I put it out and I think it's the most important podcast I've ever put out so I kind of felt like my job was done from a podcasting perspective after that and it's been incredibly gratifying I think it has certainly helped a fair number of people and it was also really hard because what I didn't anticipate was I would say of my really super high performing close male friends maybe half reached out to me to tell someone for the first time about their extremely awful graphic firsthand experience of being sexually abused the

03:13:32 percentages were mind-blowing like the the actual percentages were super super super high uh which is part of the reason I mentioned earlier I think it's good to spend a little bit of time in those empty spaces to see you know am I in a positive energetic sense pursuing something good or am I running away from demons whipping my back and for a lot of those guys I'm sure it's true for a lot of women too like they they find medication through intense focus and achievement uh which is super adaptive

03:14:12 in a lot of ways but it doesn't always have lifetime reliability [Music] and that's the story um it's impossible to hear those stories your story without um feeling some substantial emotion I'm not trying to intellectualize it's um both both of those uh aspects of your history that you shared are huge they really are they're obviously huge for you and and they're huge in terms of

the positive impact in the world I know this because um I have read the comments right and I and I've talked to people who have

03:14:54 listened to those podcasts and read those blogs and um and have similar or maybe different stories of trauma but I think uh as with your work in the Psychedelic space as with your work in um the physical augmentation space whatever you want to call it um it's apparent that you're willing to be first man in on a lot of things and really make you're sitting alone there in those moments and uh these categories of revealing trauma are in my mind anyway so much more substantial in terms of their impact positive impact and the

03:15:30 other aspects for our body and psychedelic work etc is also tremendously impactful so that's saying a lot so just want to say thank you for for your uh bravery and um thanks Andrew yeah it's um it's crazy because I think that a lot of people um can imagine telling a story or to a close friend or something but you know to put it out into the world you know it's like it's huge like you don't know how that's going to Ripple um and you've been a real Pioneer and example for uh for me for for LAX for other people and

03:16:03 revealing things not like that um but different and Peter AA has recently been opening up about some serious challenges that he's had in his in his book he does that on podcast he's been doing it so um you know yet another category um arguably the most important category for um exploration and sharing and you know thoughtful bravery right because you didn't just put it out there in any form so uh one thing I do know by experience is there's nothing weirder than being uh told thank you for the painful thing that you did so I don't

03:16:35 want to push that too far but I'd be remiss if I didn't because it it really has its impact and for doing it again here today because um so yeah that huge thanks for doing that yeah my pleasure and I also say you know I got advice from a very very experienced uh psychedelic facilitator at one point who said take the pain to make it part of your medicine and the way I think that applies here is we all experience pain we all experience suffering many of us have experienced trauma of one type or

03:17:15 another and that can consume you I mean it can consume you but it's like fire right it can consume you but you can also harness it and use it for different things and I know for I think it's I'm not going to hedge I'll say I know for a fact that there are people I've spoken to who are suicidal and by the way I'm not inviting everyone who's listening if you are suicidal to reach out to because it won't work I've had to disengage from that because it gets too heavy right just to engage one-on-one with people who

03:17:48 are suicidal but there are resources in that post Dimension the Practical thoughts on suicide but let's just talk about closer friends people you would never suspect in a million years who were this close to blowing their brains out people folks would recognize in some cases the fact that I was also there once is why they listen to me because I have unfortunately I'm a sub matter expert right I have credibility and that actually is very redeeming it provides some meaning to the suffering that I experienced it's

03:18:26 like okay here I am for whatever host of reasons I am put in this place and time with this person and they don't trust the input of these other people they're talking to because those people don't know what it's like but I can look at this person in the eye and be like oh I know and that's just a different thing so you can you can find a way to transmute that pain into something meaningful into a gift that hopefully you can share in some way not necessarily with the whole wide world just one person that's a big deal

03:19:07 one person's a big deal there's a lot out there that is intended for Mass consumption that gets in front of millions of people doesn't really impact a single person very much so even if you don't have podcast you don't have books if you have the ability to sit down with one person and really make an impact that's actually more meaningful than most of the crap that gets put out there so take heart Amen to that i' like to spend a little bit of time talking about the roles you see yourself in you know I I had this list

03:19:39 coming in here of okay you've done the um exploration of the health sphere you um self- experimentation you you're uh you've been an investor you are an investor you're podcaster you're you know I think these are more than titles I I think titles are great but titles are what we get from other people telling us what we do or deciding what we do um I'm more interested in how you think about yourself like your your own role identity and you know I have to assume you've spent a little bit of time on

03:20:16 this like if when we to go through the the checklist of possible roles yeah right okay I confess I do this I think like okay like I I think I call I think I check the box of animal because we're we're animals after all and we're you know humans you still pole dancing I think he's a pole dancer absolutely not um are you still Tango dancing I'm planning on getting back into it great that that does have some background I have Argentine lineage and I'm embarrassed to say I don't Tang uh know Tango but you got the you got the mate

03:20:46 in the in the green room so you're s my my uh grandparents uh Tango into their 80s I think late '80s yeah late 80s yeah ate steak and smoked cigarettes and uh lived until their 90s artine dieted Champions exactly um but I'm curious about the roles that you see yourself in like you know um role identity to me is so important um in terms of where we see ourselves now and where we

see ourselves going forward and who knows maybe you don't have any Ro identity plan but you know what are some boxes that you see

03:21:19 yourself in now that you really strongly identify with and then what are some boxes that um you'd like to check off going forward so current boxes I would say the two that I probably identify with most maybe three but I I'll I'll focus on two experimentalist which can take a lot of forms that can that can apply to a whole lot of different spheres so experimentalist and then teacher and for the longest time long long time I thought eventually I would go back and actually be a ninth grade teacher because I feel like that

03:22:02 is such a critical window for so many kids where they can either hit an inflection point and go in a really good direction or they can go in a really bad Direction and I certainly saw that on Long Long Island with a lot of my friends a lot of overdoses bunch of friends who have died of opiate addiction and various things and I had some intervention with mentors early on that that sort of flipped the switch on the railroad track and sent me in a different direction so I thought for a long time I would go back and be a

03:22:33 ninth grade teacher and my impulse to experiment leads to enthusiasm for teaching if that makes any sense because I feel like as good as I might be or decent at taking a complex subject deconstructing it applying 820 putting things in order and learning things very quickly uh which includes stress testing assumptions in that uh sort of assumed progression for skill like language learning there's so many myths in language learning as an example if it takes me say six months to become reasonably competent in field X I

03:23:19 can usually get other people to that same point of competence in a third of that time so for me it's very gratifying to teach and I view all the books as teaching tools I'm no totoy I recognize I'm not the world's greatest writer I take the writing seriously uh I don't have asset I do many many many revisions even for punch it's like 27 revisions for a short story called cockp so I take it seriously but I recognize that I'm not the world's greatest Wordsmith but I am looking for outcomes in readers or listeners and I

03:24:00 view my job as that of teacher so I'd say experimentalist and teacher of the two and those both go a long way and applies to say dog training you know lots ran lots of experiments and then for was listening to him just looked under the table one thing I should have said at the beginning and I did not is that um this is the first H Lab podcast to feature a guest who brought their dog so we have Molly is here as well and we're absolutely delighted uh there has not been a dog at on the hubman Lab podcast since uh Costello passed away

03:24:38 and uh I'm you know practically floating in in Delight that Molly's here today she's she's amazing and you've done amazing job training her too so thank you yeah she's she's laying right next to my feet licking my hand as I speak so good and I'd say if I were to expand that by one I would probably say explore but the exploring goes hand in hand with the experimentation uh so that could be Geographic exploration it could be spending time with people who are excellent at anything in any field MH and seeing

03:25:16 where that gingerbread Trail leads me and I think the the exploration and the experimentation are for me bed fellows they go together what about roles that you would like to explore or potentially see yourself in I mean I don't have a magic wand but if I did as a fellow podcaster and I consider you a friend uh I would say okay like if I could wand you to the success in given role that wouldn't be the way it would work that wouldn't be as gratifying as having to figure it all out cuz that's part of your your

03:25:51 Machinery uh as you just told us so yeah what are some role life roles that you're interested in expanding and uh or stepping into that you haven't explore I'd say more more artists more Artistry especially in the visual sense because I wanted to be a comic book pencor for a really long time got paid as an illustrator uh towards the end of high school and during college so Illustrated books and magazines and so on then I just dropped it I dropped it when I graduated because I was kid stuff and it was time to get

03:26:21 serious and be an adult and I just cold turkey just stopped all of it and so the skills have atrophied a lot but there's still there's still a bit in there I've seen some posts on Instagram that were yeah quite good so I'm still messing around I'm still messing around and especially when I have some structure I do well so I'd like to pursue that I would like to experiment with animation so I don't know if animator would be the right label CU I most likely would not be doing the animation myself but

03:26:49 playing a role in visual art would be one uh father would be another one eventually and uh try not to be attached to it but we all play games of various types and if we get really good at certain games that are socially rewarded then you make money doing a podc or investing or whatever might be but when my when when the sort of ramp of my learning starts to flatten out a bit I tend to get bored of those games and I think that certainly one of the biggest adventures must be Parenthood so at some

03:27:33 point I think father would be on there and I should say this is very judgmental of me to say but I think there's a big difference between wanting to want to be a parent and wanting to have kids I'm I'm very cautious about saying I want to have kids because that doesn't automatically imply you want to be a good parent which is also why I thought it was very important for me to

spend a lot of time training Molly and a lot of learning there right yeah to she's like all right am I going to do the heavy lifting and the hard

03:28:05 work recognizing that kids are not deferred dogs but I do think there actually a lot of similarities uh in terms of just predictive ability if you see someone who has dogs that are terribly trained look at their kids you might see some similarity my my good friend um my good friend I'll out him here who's a mdp is their chair of Ophthalmology at Stanford Jeff Goldberg I once asked him if he has any pets and he said that he and his wife had three children as preparation for having a dog that's there is there's a quote also from a

03:28:43 book called Don't Shoot the dog which is terrible title but excellent book written by Karen PRI who was a an aquatic mammal trainer so she's training dolphins and whales and so on which don't respond to negative reinforcement you can't really hit them with a rolled up newspaper if they don't do what you want and there's a quote in that book which is something along the lines of I can't remember the attributions another trainer and it was people should not be allowed to have children until they've successfully trained a

03:29:15 chicken because also chickens like they they just don't have the brain power to respond to uh much negative reinforcements so you have to coax them to do what you want them to do with positive reinforcement and I mean Opera in classical conditioning it's kind of same Sam across the board uh whether you're like uh the CIA trying to train cockroaches to flip light switches not making that one up by the way or training will or training a cat or training a human uh training sounds bad cultivating a wonderful human yeah then

03:29:48 I think there's a lot to be learned across the board so I've successfully proven to myself that I can keep a dog alive and happy yeah and train up another happy nervous system yeah you know curate another nervous system that's a big deal oh yeah well she's also like my external nervous system so we we sort of work in tandem I pay a lot of attention to how she relates to different people I saw earlier today I mean as someone who is the owner of a Bulldog Mastiff who knew one command which was weight which is which is the

03:30:18 the by default the easiest thing to train a bulldog because it when when you by the way folks if you stop a bulldog on the street to scratch them and they look delighted they might like you but chances are they're just really relieved that they get to stop so and um Costello he had a forbrain and he was smart about what he need to be smart about but Molly is exceptional like she knows where she needs to be and she's super connected to you and she knows a ton of commands it was ridiculous staff was like delighting in

03:30:48 the number of things that Tim could get her to do just by looking at her yeah yeah yeah she's uh she's also quite calm out of the box uh which helps although it makes it harder in some respects to train because she doesn't have much food drive she liked those Maui Nei sticks we ma sticks yeah she loves the Maui NE venison sticks but she well okay I'll I'll give I'll say two things so first is if your dog is a spaz about food that's actually great news it will make your dog very easy to train in some respects uh read don't

03:31:22 shoot the dog it's it's excellent and there are some others I could recommend I had a woman named Su uh Susan Garrett on my podcast because I wanted an objective measure of successful dog training and competitors have objective measures so she was an a dog agility Champion for many years which has a lot of metrics so anyway I had her on for people who are interested but the the tip that I got from one dog trainer early on because I was trying to train Molly and I was using just some of her kibble I'd like put some kibble in a

03:31:54 bag and carried around and she was like what are you doing and I said what do you mean what am I doing she's like is that kibble I'm like yeah it's kibble and she goes she's like hey pal she's like you're at a crowded bar you got a tip with 20s nice to get your dog's attention you take your to the dog park it's like squirrels other dogs grass piss on the pavement whatever it happens to be you have to have good treats so if your dog isn't responding chances are maybe you're trying to tip with singles

03:32:18 I love it I love it well thank you for sharing the roles you see yourself in and the ones that you'd like to step into more uh I certainly feel I have the jurisdiction to say that you are an exceptional experimentalist and a phenomenal teacher we've seen this across so many you're welcome and and I'm not just speaking for myself I'm speaking speaking for so many other people as well we've seen this across so many domains it's like blogging podcast in book writing stage lecturing being a guest on a podcast you know and on and

03:32:52 on and um in terms of the roles that you want to expand into more I can't wait to see the illustrations that that emerge yeah please do uh grow that flame because I I'm excited for what comes out um punch being um just the first of them leading the charge yeah um and uh you know I can say because I know uh because I have one and because I um uh have observed many uh kids and friends uh who are fathers you're going to be an exceptional father I'm absolutely confident of that yeah I appreciate that

03:33:31 yeah and I want to say thanks for taking the time to talk with me today I've been looking forward to this so much my team knows this wait we were sort of buzzing like you we've had some Heavy Hitters on this podcast you know uh we only look to the top 1% in field and they are you know incredibly credentialed by whatever standards we happen to be exploring and they have to be

people people that I really want to talk to so um I have so much respect for what you do and the way you do it uh you certainly inspired me

03:34:03 this podcast would not exist I don't think the genre of podcasting would exist and look the way that it does had you not made the decision to start podcasting and um in anticipation of this episode did put out a ping on Twitter for questions and there were many many of them um that maybe we'll do a Q&A sometime maybe not who knows but you know one of the questions that really stood out to me was you know how does Tim feel about all these other people coming into all the spaces that he's worked and doing um successful work

03:34:33 that builds off so much of what he's done and uh I'll let you answer but for me I can say that um I've been positively inspired and built so much of what we've been doing here and um and what I think about based on the ways that you've podcasted and communicate with the public to maintain your stance and integrity in the way that you interact with people it's really inspiring and you've always been so gracious to me and uh so humble and so giving and um and at the same time I know there's a fierce guy in there who

03:35:02 likes to get it done so once again thanks for being first man in thanks for taking on all the roles that you have and that you are and that you will and thanks for being a giver we all benefit thanks Andrew uh really appreciate you saying all that and I want people to just get after it take things seriously have fun and be really really good so watching for instance what you've done which has been so spectacular so well executed makes me super happy and I don't view anyone as competition uh in the podcasting world

03:35:42 for instance in the book world I don't view it that way either and I just hope that people keep experimenting pushing the envelope and if people aren't say getting better over time if people aren't following who are substantially better than me in all of these ways uh then I would be super disappointed so every time I see someone doing something really impressive or doing something I never would have thought of I get so extremely excited I I find it really fun to watch so appreciate you also just

03:36:17 getting out there and hard charging and taking your podcast as seriously as you do I mean I I've seen the notes I've seen the setup I met the team it's it's very inspiring for me also makes me want to dust off my cleats and get back on the field so oh man you've never left the field and you've had a hand in it all so thank you so much and um hope you'll come back and visit us again here yeah I hope so it's been a real pleasure I've been looking forward to this for a long time time as well and I appreciate

03:36:48 you inviting me on till next time till next time man thank you for joining me for today's discussion with Tim Ferris I hope you found it to be as informative and as actionable as I did for links to Tim's books as well as for a link to his weekly blog please see the show note captions you'll also find a link to Tim's podcast the Tim Ferris podcast and I highly recommend that you subscribe and listen to the Tim Ferris podcast if you're learning from Andor enjoying this podcast please subscribe to our YouTube

03:37:17 channel that's a terrific zero cost way to support us in addition please subscribe to the podcast on both Spotify and apple and on both Spotify and apple you can leave us up to a five-star review if you have questions for me or comments about the podcast or guests that you'd like me to include on the hubman Lab podcast please put those in the comment section on YouTube I do read all the comments please also check out the sponsors mention at the beginning and throughout today's episode that's the best way to support this podcast not

03:37:44 on today's episode but on many previous episodes of The hubman Lab podcast we discuss supplements while supplements aren't necessary for everybody many people derive tremendous benefit from them for things like enhancing sleep for hormone support and for Focus the ubberman Lab podcast is proud to have partnered with momentous supplements to see the supplements discussed on the hubman Lab podcast go to live momentus spelled ous so that's liv.com huberman again that's liv.com huberman if you're not already following

03:38:11 us on social media I am huberman lab on Instagram Twitter Facebook and Linkedin and at all those places I discuss science and science related tools some of which overlaps with the content of the hubman Lab podcast but much of which often does not overlap with the content of the hubman Lab podcast so again it's huberman lab on all social media Platforms in addition if you haven't subscribed to our neural network newsletter it's a zero cost monthly newsletter that provides summaries of podcast episodes as well as toolkits for

03:38:40 instance toolkits for optimizing sleep or toolkits for learning in neuroplasticity or for deliberate cold Expos exposure for dopamine and on and on to sign up for the neural network newsletter simply go to hubman lab.com go to the menu scroll down to newsletter and provide your email we do not share your email with anybody thank you once again for joining me for today's discussion with Tim Ferris and last but certainly not least thank you for your interest in science [Music]

00:00:00 ANDREW HUBERMAN: Welcome to the Huberman Lab podcast, where we discuss science and science-based tools for everyday life. [MUSIC PLAYING] I'm Andrew Huberman, and I'm a professor of neurobiology and ophthalmology at Stanford School of Medicine. Today my guest is Dr. Sam Harris. Dr. Sam Harris did his undergraduate training in philosophy at Stanford University and then went on to do his doctorate in neuroscience at the University of California at Los Angeles. He is well known as an author who has written about everything from meditation

00:00:32 to consciousness, free will. And he holds many strong political views that he's voiced on social media and in the content of various books as they relate to philosophy and neuroscience. During today's episode, I mainly talk to Dr. Harris about his views and practices related to meditation, consciousness, and free will. In fact, he made several important points about what a proper meditation practice can accomplish. Prior to this episode, I thought that meditation was about deliberately changing one's conscious experience

00:01:02 in order to achieve things such as deeper relaxation, a heightened sense of focus or ability to focus generally, elevated memory, and so on. What Sam taught me and what you'll soon learn as well is that while meditation does indeed hold all of those valuable benefits, the main value of a meditation practice, or perhaps the greater value of a meditation practice, is that it doesn't just allow one to change their conscious experience, but it actually can allow a human being to view consciousness itself.

00:01:32 That is to understand what the process of consciousness is. And in doing so, to profoundly shift the way that one engages with the world and with oneself in all practices, all environments, and at all times, both in sleep and in waking states. And in that way making meditation perhaps the most potent and important portal by which one can access novel ways of thinking and being and viewing one's life experience. We also discussed the so-called mind-body problem and issues of duality and free will.

00:02:04 Concepts from philosophy and neuroscience that, fortunately, thanks to valuable experiments and deep thinking on the part of people like Dr. Sam Harris and others, is now leading people to understand really what free will is and isn't. Where the locus of free will likely sits in the brain, if it indeed resides in the brain at all. And what it means to be a conscious being and how we can modify our conscious states in ways that allow us to be more functional. We also discuss perception, both visual perception auditory

00:02:34 perception, and especially interesting to me, and I think as well, hopefully to you, time perception, which we know is very elastic in the brain. The literal frame rate by which we process our conscious experience can expand and contract dramatically depending on our state of mind and how conscious we are about our state of mind. So we went deep into that topic as well.

Today's discussion was indeed an intellectual deep dive into all the topics that I mentioned a few moments ago, but it also included many practical tools.

00:03:06 In fact, I pushed Sam to share with us what his specific practices are and how we can all arrive at a clearer and better understanding of a meditation practice that we can each and all apply. So that we can derive these incredible benefits, not just the ones related to stress and focus and enhanced memory, but the ones that relate to our consciousness. That is to our deeper sense of self and to others. Several times during today's episode, I mentioned the Waking Up app. The Waking Up app was developed by Sam Harris,

00:03:35 but I want to emphasize that my mention of the app is in no way a paid promotional. Rather the Waking Up app is one that I've used for some period of time now and find very, very useful. I have family members that also use it. Other staff members here at the Huberman Lab podcast use it because we find it to be such a powerful tool. Sam has generously offered Huberman Lab podcast listeners a 30-day completely free trial of the Waking Up app. If any of you want to try it, you can simply go to wakingup.com/huberman to get that 30-day free trial.

00:04:03 During today's discussion, we didn't just talk about meditation consciousness and free will. We also talked about psychedelics. Both their therapeutic applications for the treatment of things like depression and PTSD, but also the use of psychedelics. And we discussed Sam's experiences with psychedelics as they relate to expanding one's consciousness. I also asked Sam about his views and practices related to social media. Prompted in no small part by his recent voluntary decision to close down his Twitter account.

00:04:31 So we talked about his rationale for doing that, how he feels about doing that. And I think you'll find that to be very interesting as well. Before we begin, I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford. It is, however, part of my desire and effort to bring zero-cost-to-consumer information about science and science-related tools to the general public. In keeping with that theme, I'd like to thank the sponsors of today's podcast. Our first sponsor is Levels.

00:04:56 Levels is a program that lets you see how different foods and behaviors affect your health by giving you real-time feedback using a continuous glucose monitor. One of the most important factors in your immediate and long-term health are your blood sugar levels. And not just your overall blood sugar levels but your blood sugar levels throughout the day in response to different foods you eat, to fasting if you're into fasting, to exercise, and so forth. I started using Levels some time ago in order

00:05:21 to figure out how different foods impact my blood sugar levels, and indeed, it does that very well. It allowed me to see how certain foods really spike my blood sugar and others keep it more level. And in particular, how foods that I eat after exercise can help raise my blood glucose just enough but not so much that then I get a crash two or three hours later, which was what was happening before I started using Levels. I've made certain adjustments to my diet. I can now eat post-exercise and still have plenty of energy

00:05:46 throughout the day without any issues. It also has helped me understand how different behaviors impact my blood glucose levels. If you're interested in learning more about Levels and trying a continuous glucose monitor yourself, go to levels.link/huberman. Again that's levels.link spelled L-I-N-K /huberman. Today's episode is also brought to us by WHOOP. WHOOP is a fitness wearable device that tracks your daily activity and sleep but goes beyond activity and sleep tracking to provide real-time feedback on how to adjust your training

00:06:14 and sleep schedules in order to feel and perform better. Six months ago, I started working with WHOOP as a member of their scientific advisory council as a way to help WHOOP advance their mission of unlocking human performance. And as a WHOOP user, I've experienced firsthand the health benefits of their technology. It's clear, based on quality research, that WHOOP can inform you how well you're sleeping, how to change your sleep habits, how to change your activity habits. Even how to modify different aspects of your nutrition,

00:06:41 exercise, sleep, and lifestyle in order to maximize your mental health, physical health, and performance. So whether or not you're an athlete or you're exercising simply for health, WHOOP can really help you understand how your body functions under different conditions and how to really program your schedule, nutrition and exercise, and many other factors of your life in order to really optimize your health and performance, including your cognition. If you're interested in trying WHOOP, you can go to [join whoop.com/huberman](http://join.whoop.com/huberman).

00:07:09 That's [join whoop.com/huberman](http://join.whoop.com/huberman) today and get your first month free. Today's episode is also brought to us by Eight Sleep. Eight Sleep make smart mattress covers with cooling, heating, and sleep-tracking capacity. I've talked many times before on this podcast about the fact that sleep is the fundamental layer of mental health, physical health, and performance. Now one of the key things for getting a great night's sleep every single night is to optimize the temperature of your sleeping environment.

00:07:34 Put simply, in order to fall asleep and stay deeply asleep, your body temperature needs to drop by about 1 to 3 degrees. And waking up, on the other hand, involves a heating of your body by about 1 to 3 degrees. With Eight sleep, you can tune the temperature of your mattress cover or mattress to be cooler or hotter depending on whether or not you tend to run too hot or too cold.

And you can even vary it across the night so that you can access the best deep sleep early in the night. The so-called REM sleep, rapid eye movement sleep,

00:08:02 that's more pronounced in the later half of the night. And doing so really get your sleep optimized not just in terms of duration but in terms of quality and the overall architecture of your sleep. This has a profound influence on your alertness, focus, mood, and many other important factors throughout the day. If you'd like to try Eight Sleep, you can go to eightsleep.com/huberman to save up to \$150 off their pod three cover. Eight Sleep currently ships to the USA, Canada, United Kingdom, select countries in the EU,

00:08:28 and Australia. Again that's eightsleep.com/huberman. The Huberman Lab podcast is proud to announce that we are now partnered with Momentous supplements. Because Momentous supplements are of the very highest quality. They ship internationally, and they have single-ingredient formulations. If you'd like to access the supplements discussed on the Huberman Lab podcast, you can go to live momentous spelled O-U-S so livemomentous.com/huberman. And now, for my discussion with Dr. Sam Harris. Dr. Sam Harris.

00:08:55 SAM HARRIS: [LAUGHTER] ANDREW HUBERMAN: We're just talking about this. SAM HARRIS: Yes, doctor. ANDREW HUBERMAN: You are indeed a doctor. [INTERPOSING VOICES] SAM HARRIS: I cannot save your life, but I am-- I might save your non-existent soul if we talk long enough. ANDREW HUBERMAN: [LAUGHTER] Well, neither of us are clinicians, but we are both brain explorers from the different perspectives. Some overlapping. SAM HARRIS: Yeah. ANDREW HUBERMAN: And I'm really excited to have this conversation. I've been listening to your voice for many years

00:09:21 learning from you for many years. And I'd be remiss if I didn't say that my father, who's also a scientist, is an enormous fan of your Waking Up app. SAM HARRIS: Nice. That's great. ANDREW HUBERMAN: And has spent a lot of time over the last few years. He's in his late 70s. He's almost 80. He's a theoretical physicist walking to the park near his apartment and spending time meditating with the app. Or sometimes separate from the app but using the same sorts of meditations in his head. SAM HARRIS: Yeah.

00:09:48 ANDREW HUBERMAN: So he kind of toggles back and forth. And even-- I shouldn't say-- even but-- yes, even in his late 70s, has reported that it has significantly shifted his awareness of self and his conscious experience of things happening in and around him. And he was somebody who, I think, already saw himself as a pretty aware person. SAM HARRIS: Yeah. ANDREW HUBERMAN: Thinking about quantum mechanics and the rest. So a thank you from him indirectly. SAM HARRIS: Oh, that's great. ANDREW HUBERMAN: A thank you from me now directly.

00:10:23 And I really want to use that as a way to frame up what I think is one of the more interesting questions in not just science and philosophy and psychology but all of life, which is what is this thing that we call a self? As far as I know, we have not localized the region in the brain that can entirely account for our perception of self. There are areas, of course, that regulate proprioception, our awareness of where our limbs are in space. Maybe even our awareness of where we are in physical space.

00:10:52 There are such circuits, as we both know. SAM HARRIS: Yeah. ANDREW HUBERMAN: But when we talk about sense of self, I have to remember this kind of neuroscience 101 thing that we always say. When you teach memory, you say you wake up every morning, and you remember who you are. You know who you are. Most people do. Even if they lack memory systems in the brain for whatever reason, pretty much everyone seems to know who they are. What are your thoughts on what that whole thing is about? And do we come into the world feeling that way?

00:11:21 I would appreciate answers from the perspective of any field-- SAM HARRIS: Yeah. ANDREW HUBERMAN: --including neuroscience, of course. SAM HARRIS: Yeah. Well, big question. I mean, the problem is we use the term self in so many different ways, right. And there's one sense of that term, which is the target of meditation, and it's the target of deconstruction by the practice and by, as you said, any surrounding philosophy. So you'll hear, and you'll hear it from me, that this self is an illusion, right.

00:11:51 And that there's a psychological freedom that can be experienced on the other side of discovering it to be an illusion. And some people don't like that framing. Some people would insist that it's not so much an illusion, but it's a construct, and it's not what it seems, right. But it's not that every use of the term self is illegitimate. And there are certain types of selves that are not illusory. I mean, I'm not saying that people are illusions. I'm not saying that you can't talk about yourself

00:12:26 as distinct-- yourself as the whole person and with as psychological continuity with your past experience as being distinct from the person and psychological continuity of some other person, right. I mean-- because obviously, we have to be able to conserve those data. It's not fundamentally mysterious that you're going to wake up tomorrow morning still being psychologically continuous with your past and not my past, right. And if we swapped lives, that would demand some explanation. So the illusoriness of the self doesn't

00:12:59 cut against any of those obvious facts. So the sense of self that is illusory. And again, we might want to talk about self in other modes because there's just a lot of interest there psychologically and ultimately scientifically. The thing that doesn't exist-- it certainly doesn't exist as it seems and I would want to argue that it actually is just a proper illusion, is this the sense that there is a subject interior to experience in addition to experience. So most people feel like they're having

00:13:37 an experience of the world. And they're having their-- an experience of their bodies in the world. And in addition to that, they feel that they are a subject internal to the body, very likely in the head. Most people feel like they're behind their face as a kind of locus of awareness and thought and intention and that every-- it's almost like they're-- you're a passenger inside your body. You don't-- most people don't feel identical to their bodies. And they can imagine this is sort of the origin, the psychological origin,

00:14:09 the folk psychological origin, of a sense of that there might be a soul that could survive the death of the body. I mean, most people are what my friend Paul Blum calls common sense do lists. You-- you're just the default expectation seems to be that whatever the relationship between the mind and the body, there is this-- there's some promise of separability there, right. That the-- and whenever you really push hard on the science side and say, well, no, no, the mind is really just what the brain is doing, that

00:14:42 begins to feel more and more counterintuitive to people, and there still seems some residual mystery that at death maybe something is going to lift off the brain and go elsewhere, right. So there's this sense of dualism that many people have. And obviously, that's supported by many religious beliefs. But this feeling it is a very peculiar starting point. People feel that in a-- they don't feel identical to their experience. As a matter of experience, they feel like they're on the edge of experience.

00:15:18 Somehow appropriating it from the side. You kind of on the edge of the world. And the world is out there. Your body is, in some sense, an object in the world which is different from the world. The boundary of your skin is still meaningful. You can sort of loosely control your body. I mean, you can't control it-- you can control your gross and subtle voluntary motor movements, but you can't-- you're not controlling everything your body is doing. You're not controlling your heartbeat and your hormonal secretions and all of that.

00:15:52 And so there's a lot that's going on that is in the dark for you. And then you give someone an instruction to meditate, say. And you say, OK, well, let's examine all of this from the first person side. Let's look for this thing you're calling I. And again, I is not identical to the body. People feel like their hands are out there. And when-- if they're going to meditate, they're going to

close their eyes very likely. And now they're going to pay attention to something. They're going to pay attention to the breath or the sounds.

00:16:21 And it's from the point of view of being a locus of attention that is now aiming attention strategically at an object, like the breath, that there's this dualism that is set up. And ultimately, the ultimate promise of meditation. I mean, there are really two levels at which you could be interested in meditation. One is very straightforward and remedial and non paradoxical and very well subscribed. And it's the usual set of claims about all the benefits you're going to get from meditation. So you're going to lower your stress,

00:16:55 and you're going to increase your focus, and you're going to stave off cortical thinning, and there's all kinds of good things that science is saying meditation will give you. And none of that entails really drilling down on this paradoxical claim that the self is an illusion or anything else of that sort. But from my point of view, the real purpose of meditation and its real promise is not in this long list of benefits. And I'm not discounting any of those though the science for many of them is quite provisional.

00:17:29 It's in this deeper claim that if you look for this thing you're calling I. If you look for the sense that there's a thinker in addition to the mirror rising of the next thought, say, you won't find that thing. And you can-- what's more, you cannot find it in a way that's conclusive and that matters, right. And it has-- there's a host of benefits that follow from that discovery which are quite a bit deeper and more interesting than engaging meditation on the side of its benefits. You know, de-stressing, increasing focus,

00:18:06 and all the rest. ANDREW HUBERMAN: I have a number of questions related-- SAM HARRIS: Sure. ANDREW HUBERMAN: --to what you just said. And first of all, I agree that the evidence that meditation can improve focus, reduce stress, et cetera. It's there. It's not an enormous pile of evidence, but it's growing. And-- SAM HARRIS: Yeah. ANDREW HUBERMAN: --I think that especially for some of the shorter meditations, which I these days view more as perceptual exercises. I've talked about this in the podcast before.

00:18:32 But for those who haven't heard it before about perception. You can have extra perception extending to things beyond the confines of your skin. Interception, which is, I think, also includes the surface of the skin but everything inward. And meditation through eyes closed typically involving some sort of attentional spotlighting, something we'll get into more. Interior receptive versus external receptive events, et cetera, including thoughts. And-- so I think of-- at a basic level meditation as somewhat

00:19:02 of a perceptual exercise. You can tell me where you disagree there, and I would expect and hope that you would. SAM HARRIS: Yeah. ANDREW HUBERMAN: But I would like to just touch on this idea that you brought up because it's such an interesting one. Of this idea that our bodies are containers and that we somehow view ourselves as passengers within those containers. That's certainly been my experience. And the image that I have is of-- as you say, that is of myself or of people out there that sit a few centimeters below the surface

00:19:34 or that sit entirely in their head. And, of course, the brain and body are connected through the nervous system. I think sometimes a brain is used to replace a nervous system, and that can get us into trouble in terms of coming up with real directions and definitions. But the point is that there is something special about the real estate in the head. I think for as much as my laboratory, and many other scientists are really interested in brain-body connections through the nervous system and other organ systems that the nervous system binds

00:20:04 that if you cut off all my limbs, I'm going to be different, but I'm fundamentally still Andrew. SAM HARRIS: Right. ANDREW HUBERMAN: Whereas if we were to lesion a couple of square millimeters out of my parietal cortex, it's an open question as to whether or not I would still seem as much like Andrew to other people and to myself-- SAM HARRIS: Yeah. ANDREW HUBERMAN: --even. And so there is something fundamentally different about the real estate in the cranial vault. SAM HARRIS: Yeah. I mean, we are--

00:20:27 ANDREW HUBERMAN: You can even remove both of my eyes, I'd still be Andrew. And those are two pieces of my central nervous system that are fundamental to my daily life, but I'd still be me. Whereas-- and this doesn't, I think, just apply to memory systems. I mean, I think there are regions of the frontal cortex that, when destroyed, have been shown to modify personality and self-perception in dramatic ways. So it's a sort of obvious point once it's made, but I do think it's worth highlighting because there

00:20:54 does seem to be something special about being in the head. The other thing is that sitting a few centimeters below the surface or riding in this container makes sense to me. Except I wonder if you've ever experienced a shift as I have when something very extreme happens. Let's use the negative example of all of a sudden you're in a fear state. All of a sudden, it feels as if your entire body is you or is me. And now I need to get this thing-- the whole container and me to some place of safety in whatever form.

00:21:31 This is also true, I think, in ecstatic states-- SAM HARRIS: Yeah. ANDREW HUBERMAN: --where you can feel really-- when people say embodied, I wonder whether or not we normally oscillate below the surface of our body. When I say oscillate, I mean in neural terms. I mean, maybe our sensory experience is not truly at the bodily surface but sits below the bodily

surface more at the level of organ systems and within our head. And then certain things that jolt us-- our autonomic nervous system into heightened states

00:21:55 bring us into states of-- bring us closer to the surface and therefore include all of us. Again, I don't want to take us down a mechanistic description of something that doesn't exist. But does any of that resonate in terms of how you are thinking about or describing the self? SAM HARRIS: Yeah, yeah. There's a lot there. First, on the point of the brain being the locus of what we are as minds. Yeah, I mean, there are people who will insist that sort of the whole nervous system has to be thought of as a--

00:22:27 when you're talking about our emotional life and the insulas connection to the gut. And just the sense of self extends beyond the brain. But I totally take your point that a brain transplant is a coherent idea, and you would expect to go with the brain rather than with the viscera. And so, in that sense, we really are the old philosophical thought experiment of being a brain in a VAT. I mean, we essentially are already-- the VAT is our skull, and we're virtually in that situation. ANDREW HUBERMAN: A horrible movie.

00:23:04 I'm sorry I can't help but interrupt. SAM HARRIS: Yeah. ANDREW HUBERMAN: When I was a teenager, my sister and I used to go to the movies every once in a while, and we'd trade off who could pick the movie. And she took me to see once the movie Boxing Helena. SAM HARRIS: Oh yeah. ANDREW HUBERMAN: The David Lynch film-- SAM HARRIS: Which I never saw that again. ANDREW HUBERMAN: --where he amputates the limbs of a woman who he's obsessed by and keeps her. It's a really horrible-- SAM HARRIS: Yeah. ANDREW HUBERMAN: --film.

00:23:23 And about 20 minutes into it, my sister just turned to me and said, I'm so sorry. And the question there was whether or not two siblings should actually persist in a movie like that. SAM HARRIS: Right. ANDREW HUBERMAN: And we decided to persist in the movie so that we could laugh about it later. But it was rather disturbing. I don't recommend the movie. Nor do I recommend seeing it with a sibling. But in that movie, the woman, he takes her as a container and restricts her movement. Quite sadistic and horrible thing really.

00:23:50 David Lynch, interesting mind perhaps. But the idea was to question how much of the person persists in the absence of their ability to move, et cetera. Could there be love? Could there be these other affections? Anyway, a rather extreme example. But one that still haunts me. And I suppose I'm thinking about still now. SAM HARRIS: Yeah, yeah. ANDREW HUBERMAN: Yeah. SAM HARRIS: Well, so just to follow that point, there's a lot about us that we don't have access to unless we enact it physically. Like if I ask you, do you still know how to ride a bike?

00:24:27 There's no place in your memory where you can inspect but just sitting in your chair that you've retained the knowledge of how to ride a bike. Procedural memory is different from semantic or episodic memory. If I asked you, do you know your address? Yes, you can recall your address just sitting there. But if you had had a micro stroke that neatly dissected out your ability to ride a bike and left everything else intact, you might think you could ride a bike. But suddenly, you stand up next to one.

00:24:57 And you have no idea what to do with it. And that would be a discovery that would only happen if you were motorically engaged with that object. And I'm sure we could probably come up with 100 things about us that really seem core to us and not separable from our personhood which seemed to only get invoked when we're out they're moving in the world, and we have limbs, et cetera. No, it's the seat of consciousness, the right framework to talk about all of this, from my point of view, is consciousness and its contents.

00:25:41 So we have consciousness. The fact that there's something that is like to be us, the fact that the world and our internal experience is illuminated. It has a qualitative character. And then, there's the question of what is that qualitative character? What kinds of information do we have access to? What does it feel like to be us? How do different states of arousal change that? So you talked about fear. Yeah, fear can change a lot of things. And various neurological deficits, or you can add drugs to the mix.

00:26:16 You add psychedelics that radically transform the contents of consciousness. From my point of view, consciousness itself is simply the cognizance, the awareness, that is the flood lights by which any of that stuff appears. So consciousness doesn't change. But its contents change. And to come back to meditation for a second, many people think meditation is about changing the contents of consciousness. There are some contents you want to get rid of like anxiety. Other contents you want to encourage,

00:26:52 like calm, and unconditional love, or some other classically pleasant, prosocial emotion. And that's all fine. That's all possible. But the real wisdom of the 2000-year-old wisdom of meditation that really is the chewy center of the Tootsie Pop is a recognition of what consciousness itself is always already like regardless of the contents in it and the changes in contents. And this is why we might talk about this. But this is why they're mutually compatible. Psychedelics and meditation, for me, are somewhat orthogonal.

00:27:29 Because psychedelics is all about making wholesale changes to the contents of consciousness. And there's some wonderful consequences of doing that. There can be some harrowing and terrifying consequences of doing that. But generally speaking, I think used wisely, they can be incredibly valuable. And the therapeutic potential there is enormous. But the crucial

disjunction here is that there really is something to recognize about ordinary waking consciousness, the consciousness that's compatible with my driving

00:28:01 a car to get here on time. You don't have to have the pyrotechnics of being on LSD to see to transcend the central illusion that I'm saying is the thing to be transcended, which is the sense that there is a duality between subject and object in every moment of experience. And to take it back to something you said about just all of our different modes in ordinary life, the interesting thing is I think people are constantly losing their sense of self. And they're not aware of it. And there's probably an analogy to the visual system

00:28:42 here, which is to visual saccade, which perhaps you've spoken about at some point on your podcast. ANDREW HUBERMAN: Not enough. So please. SAM HARRIS: Yeah. So what happens every time we move our eyes, this is called a saccade. And we do that about three times a second or so just normally. There is the region of motor cortex that affects that movement sends what's called an efferent copy of that motor movement, which is used as information that propagates back to visual cortex, that suppresses the data of vision

00:29:19 while the eyes are moving. Because otherwise if you weren't doing that, every time you moved your eyes, it would seem like the visual scene itself was lurching around. And people can experience this for themselves if they just touch one of their eyeballs on the side, not all that hard, and kind of jiggle it. And then, you can roll it around. You can jiggle it from side to side. You can see a movement of the eyeball that's not governed by your oculomotor system delivers a jiggling of the world. Because your brain is not anticipating it

00:29:50 in the same way. And you're not producing that same predictive copy of the movement. ANDREW HUBERMAN: It's a little bit like-- we have some action sports filmmakers on our staff here that the gimbal, that holds an iPhone, like you see the kids on surfboards or skateboards or something. They're going to hold a phone while moving around or the people, the vloggers-- does anyone even still use that for phrase? SAM HARRIS: I don't know. I guess. ANDREW HUBERMAN: Moving around and it's image stabilization,

00:30:19 essentially, that keeps the camera steady. And these are more than cameras, of course, for those listening, point at my eyes. But they do far more than just what a camera would do. But this internal system of image stabilization, I can see perhaps where you're going with this, that it allows us to remain in a self-referencing scheme, as opposed to paying attention to just how confusing it is to track the visual world at some level. SAM HARRIS: Well, actually where I'm going is, that people are having this suppression of vision three

00:30:55 times a second on average. And they're not experiencing it. You're effectively going blind. And you're not noticing it. ANDREW HUBERMAN: It's very fast. SAM HARRIS: Yes, it's very fast. Now there's an analogous suppression, I would say, of the sense of self that occurs every time attention gets absorbed significantly in its object. We even have this concept of losing yourself in your work. Classic flow experiences have this quality. And this tends to be why they're so rewarding. If you're in some athletic activity or an aesthetic one,

00:31:45 or you could be having sex, or whatever it is, some peak experience, its peakness usually entails there being some brief period where there was no distance between you and the experience. For that moment, you were no longer looking over your own shoulder or anticipating the next moment or trying to get somewhere, where you weren't, or micromanaging errors. There's just the flow of unity with whatever the experience is, a surfer on the wave. And we love those experiences. And then we are continually abstracted away from them

00:32:31 by our thinking about them. We're thinking, oh my god, that was so good, or how do I get back to that? Or you're looking at a sunset. It's the most beautiful sunset you've ever seen. And then you're continually interrupting the experience of merely seeing it with a commentary about how amazing this is. And I wonder, what real estate prices are here? I mean, is it possible that I could move here. And your mind is just continually narrating a conversation you're having with yourself, however paradoxically.

00:33:00 I mean, you're telling yourself things that you already know as though there are two of you rather often. I'm looking for-- which is the water. And it's, oh, there it is. But I'm the one seeing it. Who am I saying, oh, there it is to. Is there someone else who needs to be informed about the thing I already saw. So there's something about our internal dialogue that is paradoxical. ANDREW HUBERMAN: Is there any neurologic condition call it soulectomy or anything like that where somehow people feel more unified with the self on a continual basis,

00:33:42 the observer and the actor within? State more as a complete sentence. Is there any known neurological syndrome-- makes it sound like a bad thing, but it could be a good thing. -- whereby people feel that the actor and the observer within them are unified continually? SAM HARRIS: There's not a pathological one. Some the work on the default-mode network suggests that that's at least part of the story. So the default-mode network, which has been talked about a lot of late because it has come up both in the meditation literature

00:34:19 and in the psychedelic literature. But its original discovery was that-- and the reason why I was called the default mode was is that in virtually every neuroimaging experiment ever run, they found that between tasks, when the brain was just in its default state, these midline structures would increase their activity. And then they would reliably diminish whenever the person in the

scanner was on task. And usually, that meant some outward looking visual discrimination task. But it could be visual.

00:34:56 It could be semantic. But it tends to be their eyes are open. And they're paying attention to something that's being broadcast to them through monitor goggles, or they're looking at a mirror that's showing them a computer monitor. But so the general insight was, there are these midline structures in the brain that seem to be increasing their activity when the brain is idling between tasks, waiting for something to happen. And then further experiments found tasks that actually upregulated activity there beyond baseline.

00:35:32 And those tasks seem to be self referential. So that when you ask people-- you give them a list of words. And you say, well, do any of these apply to you? Or you ask people to think about-- Actually, one experiment I did. When you're challenging people's beliefs, when you're challenging beliefs that have more of a personal significance, like political or religious beliefs, you get an upregulation in these regions as opposed to just generic beliefs about you're in Los Angeles. This is a table. That is something to which people are not holding fast

00:36:10 as a matter of identity. So anyway, both meditation and psychedelics seem to suppress activity in these regions, which we know are associated with both self-talk, mind-wandering, and explicit acts of self representation. ANDREW HUBERMAN: Could we say that they are somewhat autobiographical because they access memory systems? And in the way you're describing them, and in the way that a colleague of mine, who's been a guest on this podcast-- I don't know if you've interacted with him before. But I think you'd very much enjoy whatever interaction you

00:36:45 would have. --is David Spiegel. He's our associate chair of psychiatry. He and his father actually-- his father then he founded hypnosis as a valid clinical practice in psychiatry. And hypnosis, which is obviously a heightened sense of attention with deep relaxation, is known to dramatically suppress the default-mode network. He talks about this a lot. And I always wonder as we take down activity within the default-mode network, what what surfaces in its place, does that somehow reflect that the two

00:37:20 are normally in a push-pull? Because that's not necessarily the case. When I fall asleep, I can hallucinate. But that doesn't mean that during the day, the fact that I'm looking at objects is what's preventing me from hallucinating. If I close my eyes, I can get imagery. But there's this different illusion, the illusion of antagonistic circuitry sometimes. I don't want to take us off course, but the default-mode network seems to "want to be there," quote, unquote. It seems to be fighting for our attention,

00:37:50 unless we give ourselves a visual target, or an auditory target, or some salient experience of some kind, it sounds like. And then, I'm surprised to hear that meditation reduces activity in the default-mode network at some level because meditation to me oftentimes involves paying attention to some perceptual target. Maybe you could eventually explain as to how it might do that or why it might. SAM HARRIS: And I don't think it's the whole story because, obviously, outward-going attention is not--

00:38:22 even if you're having the kind of egoic saccade that I'm talking about, where you're actually not clearly aware of yourself. You're not clearly defining yourself as separate from experience for the moment of paying attention, so you are sort of losing yourself in your work. That's not the same thing as having the clear meditative insight of selflessness that I'm claiming is the goal of meditation. But to wind back to the original point I was making, and the reason why I drew the analogy to visual saccades,

00:38:57 I do think there's a continuous interruption in our sense of self that goes unrecognized. But the conscious acquisition of the understanding that the self is an illusion is a different experience because you're then focusing on this absence. Actually, there's another analogy to the visual system that applies here, which is to the optic blind spot, which is a good analogy for me because it cuts through a bunch of false assumptions as to where you would look for this or how this relates to ordinary experience.

00:39:41 So as many people know that in both eyes we have what's called the blind spot, which is a consequence of the optic nerve transiting through the retina, unlike cephalopods. I think cephalopods have their optic nerve, as an omniscient being would have engineered it, connecting the retina from the back. And therefore, there is no area of blindness associated with its transit back through the retina. ANDREW HUBERMAN: But our receptors are one the outside. SAM HARRIS: Exactly. ANDREW HUBERMAN: Humans, for whatever

00:40:14 reason, put photoreceptors-- well, I always say I wasn't consulted on the design phase. Something put photoreceptors, combination of things, put photoreceptors in the back. And so you actually have to send the highway of information through the pixel center of the eye. Cephalopods and drosophila, basically invertebrates, the design is more at its face logical. Mammals, very illogical design, at least as far as our judgments go. SAM HARRIS: But it gives me a good analogy. So I'll take it. ANDREW HUBERMAN: I'd like to take a brief break

00:40:50 and acknowledge our sponsor, Athletic Greens. Athletic Greens is an all-in-one vitamin-mineral probiotic drink that also contains digestive enzymes and adaptogens. I started

taking Athletic Greens way back in 2012. So that's 10 years now of taking Athletic Greens every single day. So I'm delighted that they're sponsoring this podcast. The reason I started taking Athletic Greens, and the reason I still take Athletic Greens, is that it covers all of my foundational nutritional needs. So whether or not I'm eating well

00:41:17 or enough or not, I'm sure that I'm covering all of my needs for vitamins, minerals, probiotics, adaptogens to combat stress. And the digestive enzymes really help my digestion. I just feel much better when I'm drinking Athletic Greens. If you'd like to try Athletic Greens, you can go to athleticgreens.com/huberman. And for the month of January, they have a special offer where they'll give you 10 free travel packs, plus a year supply of vitamin D3, K2. Vitamin D3 and K2 are vital for immune function,

00:41:44 metabolic function, hormone health, but also calcium regulation and heart health. Again, that's athleticgreens.com/huberman to claim their special offer in the month of January of 10 free travel packs, plus a year supply of vitamin D3 and K2. SAM HARRIS: So in any case, we have this blind spot, which I think most people learn this in school. Although, my daughters had not been taught this in school. I just showed them this for the first time a month ago. And they were briefly fascinated. And then they went to return to their screen time.

00:42:14 But anyway, you can take a piece of paper. And you make two marks on it. And then you cover one eye. And you fixate on one mark. I mean, you can look this up online if you need details about how to do this. And while staring at one fixation point, you move the paper back and forth. And you can get it to a place where the other mark disappears. And you can run this experiment long enough to satisfy yourself that there is in fact a blind spot in your visual field, which with one eye closed you don't normally notice.

00:42:47 The reason why you have to cover one eye is because each eye compensates for the blind spot of the other. Which is to say that if you close one eye and survey the visual scene, something really is missing, whatever you're looking at. If you're looking at a crowd of people, somebody is missing a head and you're not noticing it. And it's not easy to notice because the brain doesn't tend to vividly represent the absence of information. I mean, it's just part of the game that's not being rendered. It's not showing up as a break in the visual field.

00:43:22 It's just not there. And I mean, people have argued that there's a filling-in phenomenon that happens, but I think that can be misunderstood or exaggerated. ANDREW HUBERMAN: But the eye movements themselves, that you described before-- I guess, I should say that the saccade analogy about transiently and repetitively erasing the self works perfectly here because, indeed, microsaccades, little smaller saccades, occur all the time also prevent our eyes from fixating in one location long enough to observe our blind spot,

00:43:54 even if one eye is closed. So if the experiment's done with paralytics to essentially lock eyes at one location, basically, things start disappearing. SAM HARRIS: It just fades away. ANDREW HUBERMAN: We all love to think that we start hallucinating, but actually, we start going blind. And those experiments have been done on humans. I hear they're quite terrifying. SAM HARRIS: I mean, you can do that for yourself too. It begins to just all melt away in a warm glow. No psychedelics required. But the interesting point there is

00:44:25 that when you ask yourself, OK, so because as a consequence of the eyes' anatomy, there's this thing you can see that is absent from your experience. But the question is, where is that in relationship to the rest of you, to your mind? Is that deep within? Or is that in some sense right on the surface of experience? And there's expectation that people have. Again, I think conflating meditation with a search for changes in the context of consciousness. They're looking for much more subtle things to notice about the mind or much vaster things to notice.

00:45:07 Psychedelics sets up this expectation that you do a massive dose of mushrooms or LSD, and everything changes. I mean, you get this full beatific vision. And you get not only visual changes, but emotional changes. And you get synesthesia, where you have much more mind in so many ways. So they begin having these experiences, or reading the mystical literature, you begin to think, OK, well, then freedom is really elsewhere or it's deep within. It's not coincident with the ordinary awareness that can see this coffee cup clearly

00:45:54 and that can just transition attention to reading an email with the full sobriety of ordinary waking consciousness. But the truth is, this insight into selflessness, this insight into the nonduality of subject and object, is as close to ordinary consciousness as this insight into the optic blind spot. Where do you have to go to have this insight into the blind spot? you don't have to go anywhere. You just have to set up the experiment correctly such that you can see the data. But the data is right on the surface.

00:46:33 It's almost too close to you to notice. If it's at all hard to notice, it's because it's so close, rather than it's deep within or far away. And there are other analogies like-- I don't even remember. There's Mind's Eye, pieces of artwork, that were the random dot stereo grams, where we have an image that pops out. I always find it very difficult to see those because I have a very dominant eye. But some people can see. ANDREW HUBERMAN: People can't see those. These images that used to be at the touristy shops.

00:47:01 But people say, oh, there it is, the whale. And I'm thinking, I don't see it. Kids that swim a lot when they're younger, and they tend to breathe just to one side-- I don't know if this was

you. This was definitely me. They tend to keep one eye closed. You set up a pretty strong ocular dominance. Biasing your vision to one or the other eye early in life, whether or not you're learning how to be a bow hunter or you're learning how to throw darts or shoot billiards or anything that, involves selectively viewing

00:47:30 the world through one eye for even a couple of hours can set up a permanent asymmetry in the weighting flow of visual information from the eye to the brain. It's reversible, but only through the reverse gymnastics of covering up the other eye intentionally. So actually I had to be reversed-patched for a while because I was seeing double, because I lost binocular vision. I don't stand a chance in hell of seeing an image pop out of a random dot stereogram, which is kind of ironic because I did my PhD on binocular circuitry.

00:48:01 But nonetheless, if people can see these, or if they can't, I think they provide a really terrific example of what you're talking about as a larger theme, which is that perceptually you see a bunch of dots. And then all of a sudden, what you thought wasn't there is suddenly there, but can just disappear again. There are certain visual illusions, if we were to include others, that once you see them, you cannot unsee them. So there's the faces-vases, figure-ground type stuff. SAM HARRIS: Bi-stable percepts.

00:48:33 ANDREW HUBERMAN: Bi-stable percepts. And then there's sort of ocular competition. You show two different images to the eyes, each of the two eyes. And it is near impossible for people to perceive them both simultaneously. So it's a little bit of what you're describing. I mean, these seem to be fundamental features about the way the neural circuits are organized, that they don't want to stay fixated on any one thing for very long. To do so either takes training, intense interest, intense fear, intense excitement.

00:49:01 When I say intense, I guess, I come back to this idea that the autonomic nervous system is somehow governing our ability to spotlight at any one location for very long. Is that a useful framework? Or is that going to take us down a different path? SAM HARRIS: Well, it's sort of a different path for this. I mean, the only point I was making is that the seemingly paradoxical claim that something can be right on the surface and yet hard to see. And again, this seems to justify the expectation held

00:49:35 by, I would think, the vast majority of people who get interested in these spiritual things, for lack of a better word, that the truth must somehow be deep within. There's some distance between the one who is looking and the thing that has to be found right and that you have to go through this long evolution of changes. I mean, there are many metaphors that set this up. It's like you're at the base of a mountain, and you have to climb to the top. And so you have to find the path, however secure it is to get you there.

00:50:10 But there really is a distance between your starting point and the goal. And what I'm arguing-- and this is a kind of a nondual, to use a term of jargon-- this is a nondual approach to meditation, as opposed to a dualistic one. The path and the goal are coincident, that you have to unravel the logic by which you would seek something that's outside of the present moment's experience, i.e. not available, really not available to you now. Because so many things worth having, so many skills worth acquiring, really are not available to you now.

00:50:57 It's like if you want to be a pianist, or if you want to speak Chinese, there's something you don't know. And then you want to learn that thing. And there's a whole process. And you might not be capable of doing it. And real mastery is far away. If you've never hit a golf ball, and you want to hit a golf ball 300 yards straight, I can pretty much guarantee you're not going to do that initially. And you're not going to do it on day two. And you're not going to do it reliably for the longest time.

00:51:27 And there's real training in front of you to be able to do that reliably. An insight into, and really the core insight, I mean, the insight that is the core of the Buddha's teaching, to take one historical example of this, really is available now. I mean, granted, it can be very hard, one, for people. I mean, I had probably spent a year on silent retreat in one week to three month increments before I got the point I'm making now. I mean, literally, these are retreats where you spend 12 to 18 hours a day just meditating,

00:52:16 trying to unpack the kinds of claims I'm making now. So it's possible to rigorously overlook this. It's possible to stand in front of the mind's eye image and stare in a way that is guaranteed not to give you pop out and to be adept at staring in that way. So it's possible to be misled. And so what I'm trying to argue here is that there's a fair amount of leverage you can get with better information, which can cut the time course of your searching for this thing and cancel your false expectations about just

00:52:55 where this is in relation to your ordinary waking consciousness. And it's possible to get bad information and to have a bunch of experiences. You go you go and do an ayahuasca trip. And it's incredibly valuable. And it's valuable for all the ways in which it changed the contents of your consciousness in startling ways. And you had insights into your past and into your relationships and into why you're not as loving as you might be. And there's lots to think about. And you're like, OK, that's all great.

00:53:23 That's all something that we can talk about. But it truly is orthogonal. I mean, it makes a point of contact, or what I'm talking about, it's really just at one point. And it's at the point where this sense of subject-object division in consciousness is illusory and vulnerable to

investigation. And if you investigate it as the right plane of focus-- you pick the analogy you want, whether it's setting up the optic blind spot experiment in just the right way, so that you can see that the data is not there.

00:54:04 I mean, the bi-stable percept is great because when you see one of these images, like the vase-face diagram, or the Dalmatian that it looks like a mess of dots, and then you see the image of a Dalmatian dog pop out-- once you see it, you really can't unsee it. I mean, once you have the requisite conceptual anchor to it, then every time you look, you're going to find it again. And eventually, it becomes effortless. And that's what, ultimately, meditation is, I mean, this kind of meditation. You ultimately learn to recognize

00:54:42 that there's no separation between you and your experience. There's not the experience on the one hand and the self on the other. There's just experience. There's just seeing, hearing, smelling, tasting, touching, thinking, feeling, proprioception, add whatever channels of information you want to that. But there's just the totality of the energy of consciousness and its contents. And it's not that you're on the riverbank. And this is how it can seem in the beginning, even when you're practicing meditation fairly diligently.

00:55:19 You can seem like you're on the riverbank, watching the contents of consciousness flow by. And meditation is the act of doing that more and more dispassionately, so you're no longer grabbing at the pleasant or pushing the unpleasant away. You're just kind of relaxing in the most non-judgmental frame of mind, just witnessing the flow. But if you're doing that dualistically, you feel like the meditator. You feel like the subject aiming attention. And so now you're on the riverbank watching everything go past.

00:55:52 But the truth is, you are the river. Experience itself is that there is just experience itself. You're not on the edge of experience. And everything you can notice is part of the flow. And there's no point from which to abstract yourself away from the flow to stand outside it and to say, OK, this is my life. This is my experience. This is my body. Yes, you can do that. I mean, those are all just thoughts. But that's more of the flow. And so there's a process by which you would eventually recognize that there's no distance between you

00:56:31 and your experience. And again, you can wait for those moments in life where experience gets so good, or so terrifying, it's just so salient. Your amygdala is driving so hard. I mean, so you're in a war, and you can't think about anything because the enemy is shooting at you. And this is the most thrilling video game you've ever played in your life. And your life is on the line. Or you're at the peak of some athletic event, where you don't know how you're doing the things you're doing, but it's all happening automatically.

00:57:05 But those are 1/100 of 1% of one's life. And you know what I'm calling meditation is a way of simply understanding the mechanics of a tension whereby you are denying yourself that unity of experience so much of the time and recognizing that it's based on a misperception of the way consciousness always already is. ANDREW HUBERMAN: Well, if there wasn't an incentive to learn how to meditate properly, that was one. And I've been meditating for a fair amount since I was in my teens, but more along the lines of paying

00:57:46 attention to breath and open-observer type meditation, or focused-attention. I would suppose more of the focused-attention type. We'll get into these a little bit later. But I have a number of questions related to what you just said. SAM HARRIS: Sure. ANDREW HUBERMAN: I love the idea that this thing that we would all do well to understand to observe consciousness of self as opposed to trying to alter the contents of consciousness may sit much closer to us than one might think. And because it sits so close to us,

00:58:26 that might be one of the reasons why we miss it. I go right to a visual system example. I mean, if you're wearing corrective lenses and there's a speck on your lens, typically you're looking out through the lens, and so you wouldn't observe that speck. Any number of different analogies could work here. The fact that there are states, however few, positive and negative, extreme ecstasy and extreme fear being the two, I think, most obvious ones that seems like we agree on, that allow us to capture the sense of completeness of self

00:58:59 or the unity of the observer and the actor. The fact that those are seldom for the nontrained, for the nonmeditator, suggests to me two things. I think one perhaps worth exploring more than the other. But one is that what's really being revealed in the states where we can feel the unity of the observer and the actor is understanding something fundamental about the algorithm, not the online algorithm, but the algorithm that is our nervous system. Just as you mentioned cephalopods. I mean, mantis shrimp see an enormous array of color hues

00:59:36 that we don't. Their maps and representations of the world are fundamentally different. Pit vipers see in the infrared. We're restricted to somewhat of a limited range within the color spectrum, but still more vast than that of dogs or cats. So understanding that for seeing what a pit viper can see for moments would be informative. Perhaps sensing-heat emissions as a human might be invasive, maybe that's why we don't do it. So the question is, to just make it straightforward, why would the system be designed this way?

01:00:14 Again, neither of us were consulted in the design phase. But that brings me to, perhaps, the more tractable question was, which is about development. I'm a great believer that

the neural circuits that encouraged healthy parent-child relations, or unhealthy parent-child relations as the case may be, in childhood stem from the initial demands of internal versus external states, which is exactly what we're talking about, which is that a young child feels anxious because it needs his diaper change.

01:00:42 It doesn't really know it needs its diaper changed or it's cold or it's uncomfortable or it's hungry or it's overly full. And so it vocalizes. And then some external source comes to us and relieves that hopefully. And so the fundamental rule that we first learn is not that we have a self or that things fall down, not up. But it's that when uncomfortable, externalize that discomfort. And it will be relieved by an outside player. And then, of course, there's a repurposing of that circuitry for adult romantic attachments.

01:01:11 I don't think anyone doubts that. And that can explain a lot indeed about attachment and so forth. So something about our developmental wiring and the algorithms that these neural circuits run tend to bias most people, the nonpractice meditators, to live a somewhat functional life at least without this awareness of actor and observer. And so what you're really talking about is a deliberate intervention to understand and resolve that gap in the algorithm. Do I have that right?
SAM HARRIS: Yeah. ANDREW HUBERMAN: I'm more or less

01:01:51 restating what you said in a way that, I'm hoping, will serve as a jumping off point. Why questions are always very dangerous in biology, or any. SAM HARRIS: Or in relationship.
ANDREW HUBERMAN: What's that? SAM HARRIS: Or in relationship. ANDREW HUBERMAN: Or in relationship. Right. Exactly. Although, I think it all does really hearken back to this early developmental wiring which, of course, is modifiable. That's the beauty of the nervous system is, it's the one organ that seems to be able to change itself

01:02:15 at least to some degree. So what are your thoughts about the organization of the circuitry to essentially under normal conditions to not reveal what seems to be one of its more important and profound and, for dare I say, enlightening features. It's almost as if we are potentially like mantis shrimp. We can see so many more colors than we actually see. And yet, we don't. Most people opt not to. And I would argue that one of the great strengths of the Waking Up app, for instance, is that it essentially walks you through the process of being

01:02:56 able to arrive at these things without having to go to one-year or three-year long silent meditation retreats. So if you could just elaborate for a moment before we move on. What are your thoughts about how the circuitry is arranged by default versus-- and what that means for there to be an intervention, that we have to intervene in the self in order to reveal the self. SAM HARRIS: Well, so there are two big questions there, one about evolution and one about development. So with respect to evolution, it's

01:03:28 important to recognize that evolution doesn't see our deepest concerns about human flourishing and human well-being. ANDREW HUBERMAN: It's all about the offspring. SAM HARRIS: We are set up to spawn and to survive long enough to help our progeny spawn if we can do that. And that's it. And so anything that was good for that, including tribalism and xenophobia and all kinds of hardware and software flaws that revealed themselves to be flaws in the present time, when we're trying to build a viable global civilization.

01:04:09 But they redounded to the advantage of our ancestors somehow, or there are things about us that were simply not selected for, they just came along for the ride, what Stephen Jay Gould called a spandrel. So we are not set up by evolution to be as happy as we possibly can be and to do almost anything that interests us well. I mean, we're not set up by evolution to be mathematicians or musicians or to create democracies that are healthy. I mean, evolution can see none of this. And we are doing these things based

01:04:51 on cognitive and emotional hardware that we are leveraging in new directions. I mean, we are primates. And we're communicating with small mouth noises. I mean, we're language-using primates. And all of that is clearly evolved. And we're doing these amazing things, including science. However improbably, where we're actually able to, almost entirely with language, understand reality that at a scale that exceeds us in both directions, I mean, the very vast and the very small, and also temporally, the very old.

01:05:31 We have visions of the far future. We can figure out where an asteroid is going to cross Earth's orbit 1,000 years from now if we just do the math. And it's amazing that we can do all of those things, but evolution is blind to all of that. And so in terms of what we care about and certainly in terms of what's going to ensure our survival as a species, we have flown the perch that was created for us by evolution. I mean, it's not just the primate things. And so it is with learning how to regulate our emotions

01:06:06 and punch through to a self concept or beyond a self concept that is more normative, psychologically, that allows us to not be terrorized by our ape-ish genes as fully as we seem to be, even in the presence of more and more destructive technology. I mean, we're still practically chimpanzees armed with nuclear weapons. And that is increasingly dysfunctional. And very soon we're going to be in the presence of minds, or apparent minds, that we have built that are as intelligent as we are and very quickly, probably 15 minutes after that, far more

01:06:47 intelligent than we are. And so what we do with all of that is, again, something that we have to figure out based on the minds we have, the minds we can build, the minds we can

change. We can meddle with our own genomes now. And that will produce its own consequences in ourselves and in future generations if we meddle with the germline. And again, all of that is just evolution. It's just sort of the womb we came out of, but it didn't anticipate any of that. Mother nature simply not had our best interests at heart.

01:07:26 And we might die off, and from the point of view of mother nature that's fine because 99% of every species dies off. So there's that. But when you're talking about the individual, developmentally-- we all come into this world, again, as a fairly hairless primate that needs a tremendous amount of care by others. And the logic of that is that the reason why we're not a gazelle that can run 45 minutes later and then, basically, do all the gazelle things perfectly soon thereafter. The reason why we have this time of immaturity,

01:08:17 and has become functional for us, is that we're far more flexible, and we can learn based on the needs of an environment to do so much more than a gazelle can. And language is part of that. And in the last 10,000 years or so, culture increasingly has been more and more a part of that. And there's probably a layer at which we can plausibly talk about cultural evolution and cultural evolution interacting with biological evolution to change us. But when you're talking about the development of an individual, each of us comes into this world, I think,

01:08:58 not recognizing ourselves in any sense that would make sense to reify. I mean, it's not that there's nothing there. I mean, there could be some kind of proto-self differentiation. But I think it takes a long while. And there is very likely a coincidence between really recognizing others. We recognize others first. certainly in relationship immediately. And we orient to human faces. And we even detect other humans as good and bad moral actors very early, I mean, certainly long before we recognize ourselves in a mirror.

01:09:41 The experiments run, again, this is Paul Blume and colleagues, experiments run on the moral hardware and software of developing toddlers. But I think at this point, they've pushed it down all the way to six months of age, where you'll get these infants staring at a puppet show. And they'll show a greater interest in classically good actors versus bad actors, cooperators versus defectors, in various puppet show games. So it's not that we have no mind and no proto-awareness of others and of self, but what eventually happens,

01:10:26 certainly as we become at all facile with language use, is that we become aware that not only are we in relationship to others, but we are an object in the world for them. So we have enough people pointing at us in our cribs and impinging upon our experience. You're being physically moved, and prodded, and touched, and consoled, or not consoled. And just imagine what all of these-- you're on the receiving end of 10,000 interventions. And you're completely helpless for the longest time. And all of that attention, you have

01:11:06 all of these people coming up to the crib and making faces at you-- ANDREW HUBERMAN: Cheering for you. SAM HARRIS: And it's all pointed at you. There's a classic magical narcissism that gets constructed there if you take the psychological literature, at least a certain strand of it, seriously. And I think it's largely apt to think of a child at that age as a kind of-- there is a kind of narcissistic structure there, where it's all kind of going inward. And at a certain point you realize, OK, I'm

01:11:49 the center of all of this. It's not just a movie where you're completely absorbed in, and you've lost your sense of self. I mean, to talk to yet another example of what it's like as a grown up to lose our sense of self. And one of the things I think we find so fascinating about television and film is that when we get totally absorbed in it, we're in this very unusual circumstance where our brain is basically reading it as we're in the classic social circumstance. We're presented with the facial displays of other people.

01:12:28 In fact, sometimes these people are 10 feet tall or their faces are 10 feet tall. You have a close-up in a movie theater. So it's like a super stimulus, in terms of evolution. And they can be making direct eye contact with a camera, so you have this gigantic face staring at you. And yet, you're totally uncomplicated socially. You can't be seen. And something you know you can't be seen. And so you completely lose self consciousness. And yet, you're able to examine with completely free attention,

01:13:02 again, because you're totally unimplicated, the facial minutia and the mimetic facial play of people at a very close range. I mean, you have physically just about to kiss your spouse, like that's what a close-up is in a film. You never get that close to people. And yet, here you're in a situation where you're unobserved. And you know that. And so I mean, this is a bit of a tangent, but it's the other side of what's happening developmentally for a kid. When you're in a movie theater watching a movie,

01:13:41 you are truly invisible. And yet, you're right there. However harrowing the human drama is, you're seeing it play out. And you're seeing it up close. And it is, in principle, a social encounter that your genes are ready for, but they're not ready for you to be invisible. And so that's what's so magical about it. But what happens developmentally for a kid is that you're not invisible, you are an object that is constantly being overrun, the boundaries of your sensory engagement with the world are constantly being impinged upon by others.

01:14:18 And at a certain point, you recognize, OK, I'm at the center of this. And the way this gets enshrined as a self, I think is probably coincident with our learning the language game we learn

to play with others. We're talking to others. People are talking to us. And at a certain point, we're talking to ourselves, even when the other people leave the room. And you can hear it. If you ever have been with a toddler when they're externalizing their self-talk, you hear them talking to themselves. They're playing.

01:14:54 And they're having a conversation. They were talking to you, the parent. But then you left the room, and they're still talking. You come back in, and they're still talking. And what happens to us, strangely, and this comes back to the logic of evolution, we never stop because evolution never thought to build us an off-switch for this. I mean, language is so useful. And it gets tuned up so strongly for us. And there was never a reason to shut it off. There was never a reason to give you this ability

01:15:28 to say, oh, wouldn't it be nice to have four hours of quiet now, like no self-talk. And so for most of us, I mean, I think there are people who, for whatever neurological reason or idiosyncratic reason, undoubtedly there'd be a neurological reason for it, don't have any self-talk. But for most of us, we are covertly talking basically all the time. And there's an imagistic component of this for many people. You're visualizing things as well. But there's just a ton of white noise in the mind that

01:16:05 feels a certain way. And what you discover in meditation, ultimately, is that the self is what it feels like to be thinking without knowing that you're thinking. A thought arises uninspected and seems to just become you. Like you and I are talking now. And people are listening to us. They're struggling to follow the train of this conversation because it is competing with the conversation that's happening in their heads. So I'll be saying something. And a person listening will say, well, what does that mean?

01:16:41 Or like, oh, but wait a minute, he just contradicted himself. And there's a voice in your head that is also vying for your attention much of the time. So the first discovery people make in meditation is that it's just so hard to pay attention to anything, the breath, or a mantra, or a sound, whatever it is, because you're thinking. You're thinking about the thing you need to do in an hour. And oh, it's so good that I downloaded this app. This is really good. This is going to be good for me. But that chatter isn't showing up.

01:17:15 You're not far back enough in the theater of consciousness, so as to see it emerge. It is just sneaking up behind you. And it feels like me again. It feels like when someone is thinking the thought, well, what the hell does that mean? They're not seeing it as an emerging object in consciousness. It just feels like me. Subjectively, is like the mind contracts around this appearance in consciousness. And it really is just a sound with the voice of the mind. If you actually can inspect it, it is deeply inscrutable

01:17:58 that we ever feel identified with our thoughts. I mean, how is it that we could be a thought? A thought just arises and passes away. And when you inspect it, when you go to inspect it, it unravels. It's the least substantial possible thing. But yet, it could be a thought of self-hatred. It could be a thought, that unrecognized, totally defines your mood. I mean, again, this all can seem kind of abstract. ANDREW HUBERMAN: Well, no, but I think it's extremely concrete from the perspective of the neural circuits that will return

01:18:41 to maybe in a few minutes. I'd like to take a brief break and thank our sponsor Inside Tracker. Inside Tracker is a personalized nutrition platform that analyzes data from your blood and DNA to help me better understand your body and help you reach your health goals. I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate and long term health can only be analyzed from a quality blood test. The problem with a lot of blood and DNA tests

01:19:07 out there, however, is that you get data back about metabolic factors, lipids, and hormones, and so forth, but you don't know what to do with those data. Inside Tracker solves that problem and makes it very easy for you to understand what sorts of nutritional, behavioral, maybe even supplementation-based interventions, you might want to take on in order to adjust the numbers of those metabolic factors, hormones, lipids, and other things that impact your immediate and long-term health to bring those numbers

01:19:33 into the ranges that are appropriate and indeed optimal for you. If you'd like to try Inside Tracker, you can visit insidetracker.com/huberman and get 20% off any of Inside Tracker's plans. That's insidetracker.com/huberman to get 20% off. If you could elaborate a bit on this notion of internal chatter and external stimuli and the bridge between them because I think for some people that might be intuitive. I think for others, it's not so obvious that language is ongoing in the backdrop. And then sometimes, I think some people are

01:20:11 more tuned into that language. For some people, it's louder volume. For some people, it's more structured. I have a colleague at Stanford who's been on this podcast called Deisseroth. He's one of, like, the preeminent bioengineers. He's also a psychiatrist. And he has a-- he doesn't call it a meditative practice, but he has a practice where each evening, after his five kids are put down to sleep, you know-- they're older now-- and in the quiet of the late hours of the night, early morning, he sits and forces

01:20:43 himself to think in complete sentences, with punctuation, for an hour. This is the way that he has taught himself to structure his thinking, because of the very fact that you're

describing, which is that ordinarily, there is an underlying structure to what's internal, but it's disrupted by external events, And these are-- typically, it's not coherent enough to really make meaning from. So it's almost like somebody sitting down to write in complete sentences, but forcing himself to do it in his head.

01:21:10 But for many people, including myself, that's a foreign experience. And we only experience structure through our interactions with the world and other people. I've taken the time to try and explore ideas with eyes closed. And I've been able to do that. There are certain pharmacologic states that we could talk about that facilitate that. And no, those are not amphetamines. Those do exactly the opposite, by the way. But I think people exist in varying degrees of structured and unstructured internal dialogue,

01:21:45 and in varying depths of recognition of that internal dialogue. And so the question, I suppose, is, just the recognition that there's a dialogue ongoing, internally-- is that, itself, valuable? SAM HARRIS: Yeah. And that also can take some time. So, I mean, here's a claim I would make that some people might find surprising. But I think this is an objectively true claim about the subjectivity of most people, which is that unless you have a fair amount of training-- let's say you just happen to be

01:22:18 some kind of savant in this area, which most people, by definition, aren't, or you have a remarkable amount of training in what's called concentration practice in meditation-- I believe this is a true claim-- that if we just put a stopwatch on this table, and people could just watch it 30 seconds elapse, and I set all of our listeners, or your viewers, the task, for the next 30 seconds, just pay attention to anything-- your breath, you know, or the sight of your hand, or the sight of the clock,

01:22:57 or any object-- without getting lost in thought, without getting momentarily distracted by this conversation you're having with yourself. A couple of things would happen. One is no one would be able to do it, right? And this is not just a superficial inability. I mean, if your life depended on it, you wouldn't be able to do it. I mean, if the fate of civilization depended on it, none of our listeners would be able to do this. And yet, some percentage of them are so distracted by thought that they will actually try this experiment

01:23:39 and think they succeeded. Right? And for these people, what happens is you put them on a meditation retreat, and you have them spend 12 hours a day in silence, doing nothing but this. Right? So the practice is just pay attention to the breath when they're sitting, and then eventually, you incorporate everything-- sounds and other sensations. And then you interleave that with walking meditation, where they're paying attention just to the sensations of lifting and moving and placing their feet. And then once the practice is going,

01:24:04 you incorporate sounds and sights and everything. So you can pay attention to everything, but the goal is, for every moment, you are going to cultivate this faculty of mind, which increasingly is known as mindfulness. Right? And mindfulness is nothing other than this very careful attention to the contents of consciousness. But the crucial piece is it is not a moment of being lost in thought. Right? You're not blocking thoughts. Thoughts themselves can arise. But in those moments of being truly mindful,

01:24:39 you're noticing thoughts as thoughts. Whether it's language in the mind or images, you're noticing those, too, as spontaneous appearances in consciousness. So if most people-- you know, certainly anyone who thinks they can pay attention to-- who can do the experiment successfully that I just suggested-- pay attention to something for 30 seconds without being lost in thought-- you put those people on a meditation retreat, what they're going to experience is, you know, on the first day, they're going to feel, like, oh, yeah.

01:25:13 I was with the breath, or I was walking-- you know, I was with the sensations of walking-- and I'd be there for, like, five minutes solid, and then I would get lost in thought. And then I'd come back. And then five more minutes, I'd be lost in thought, and then get back. But as the days progressed-- even, you know, 10 days in to a silent meditation retreat-- they're going to experience more and more distraction. It's going to seem like, OK, wait a minute. Now I can't pay attention to anything for more than 5 seconds.

01:25:41 Right? That is progress, right? Because what they're discovering is just how distractible they are. Right? And you know, for some people, that will be immediately obvious. For some people, it'll actually take a lot of practice to realize just how distracted they are. ANDREW HUBERMAN: What you just said, which was that, at some point, we can start noticing our thoughts-- I can notice my thoughts-- but what you're talking about, as a goal state, is not being distracted by thoughts, but actually seeing the relationship

01:26:16 between thoughts, self, and other types of perceptions. And here, I think recognizing and seeing thoughts is a form of perception. It's just an internally-directed perception. This raises a topic that I'm also obsessed by, which I think neuroscience can somewhat explain, but still incompletely-- that the circuits and mechanics, et cetera, are not yet known-- which is about time perception. And you know, a simple analogy would be that there are a lot of small objects flying around in the space that we happen to be having this discussion,

01:26:56 but they're moving so fast that I can't perceive them. Or they're entirely stationary, so I can't perceive them because of the reasons we talked about before in the visual system. My

eyes are moving in perfect concert with these small object movements, and therefore, I am blind to them. SAM HARRIS: Right. ANDREW HUBERMAN: A slight shift in time perception-- think of this, perhaps, as a change in the frame rate, right? Camera frame rates. A faster frame rate, you can capture slow motion. Slower frame rate, you're going to get

01:27:26 more of a strobe-type effect if the frame rate is low enough. SAM HARRIS: Right. ANDREW HUBERMAN: Right? Could it be that our time perception is not one thing, but we have one rate of perceiving time for external objects at a given distance-- which we know is true-- another frame rate for objects that are up close-- we know this to be true, even if those objects are moving at the exact same speed, right? I mean, this would be the sitting on a train, the rungs on the fence seem to be going by very, very fast,

01:27:54 but the ones in the distance seem to be moving slowly. This is the way the visual system and time perception interconnect at some level. You're up on a skyscraper-- the little ants of cars and people down below. You know they're moving much faster than you perceive them to move, but it's a distance effect. SAM HARRIS: I mean, you see a plane, it's going to be going 300 miles an hour. ANDREW HUBERMAN: Exactly. SAM HARRIS: Yeah, yeah, yeah. ANDREW HUBERMAN: And it's not because of the lack of resolution.

01:28:16 The lack of resolution is incidental. We know this because in animals, such as hawks, that have twice the degree of acuity, as far as we know, they have the same distance-associated shifts in time perception. So could it be that we are running multiple streams of time perception, multiple cones of attention, that include cones of attention to our thoughts, and that somehow, through meditation, we start to align the frame rate for these different streams of attention so that they all fall into the same movie,

01:28:49 if you will-- although it's not just a movie with visual content. What I'm doing here is clearly, I'm becoming a lumper rather than a spreader. I'm sure this violates certain rules of time perception and neural circuitry, but I'm not sure that it's entirely untrue, either. And does it survive at all, as a possible model for what you're describing? And if the answer is no, I'm perfectly comfortable with that. SAM HARRIS: Well, it's dependent on what you mean by meditation. This is where, sort of, the particularities

01:29:21 of what one is doing with one's attention under the frame of meditation really matter, because there are ways to practice mindfulness, in particular, where the frame rate really does seem to go way, way up. Right? And there's actually been some research done on this, where you take people before and after a three-month silent meditation retreat, and you give them some kind of visual discrimination task where they have to detect-- I think they used a tachistoscope. Is that the tool for? ANDREW HUBERMAN: I'm not familiar.

01:29:56 SAM HARRIS: Something that presents, you know, very quick pulses of light. And in any case, just in any sensory channel, I would imagine you can make finer-grained discriminations if you're practicing mindfulness in a very specific way, which is to be making these fine-grained discriminations more and more, and do nothing else for three months, which is a way of practicing. So the classic mindfulness practice in what's called Vipassana meditation is to pay scrupulous attention to seeing, hearing, smelling,

01:30:35 tasting, touching in a way that breaks everything down into these kind of microscopic sensory moments. So you know, rather than feel your hands pressing together, what you're trying to feel with your attention and you're feeling more and more is all of the sensations of pressure and temperature and movement such that the feeling of hands completely disappears. You realize that a hand is a concept, and all you have is this cloud of punctate and very brief sensations. And so anything you think you have as a datum of experience,

01:31:18 as you bore into it with your attention, it resolves into this kind of diaphanous cloud of changing sensation. And that can be even something as captivating as, like, a serious pain in your body. I mean, you can have could have injured your neck, you know? And so you have some excruciating pain in your neck. If you just are willing to pay attention to it, you know, and just pay 100% attention to it, a couple of things happen. One is your resistance to feeling it goes away, by definition, because now your goal is to just pay attention

01:31:57 to it. And you recognize that so much of the suffering associated with the pain was borne of the resistance to feeling it. You're bracing against it and all of your thinking about it, you know? You're thinking, like, well, you know, why did I do this to myself, or should I see an orthopedist, or how long is this going to last? And maybe I herniated a disk. Like, all of that self-talk is producing anxiety. And I'm not saying there's never anything to think about there. But either you can do something about it in the moment or you

01:32:26 can't. And so much of our suffering in the presence of pain is the result of resisting it, worrying about it, thinking-- just all of the-- everything we're doing with our minds, but just feeling it, right? So when you just feel it, again, it breaks apart into this ever shifting collection of different sensations. And it's not one thing, and it never stays the same. So two things happen there. One is there can be a tremendous amount of relief that happens there where you can achieve a level of equanimity,

01:33:06 even in the presence of really unpleasant physical sensation. And this is true of mental sensation as well. As it's true of emotions. The classically negative emotions like anger,

depression, or fear. The moment you become willing to just feel them in all of their punctate and changeable qualities, they cease to be what they were a moment ago. When you're talking about emotional states, they cease to map back on to you and your self concept as meaningful in the same way. So that suddenly, the anxiety you feel, let's say,

01:33:45 before going out on stage to give a talk, a moment ago, it had psychological meaning, it felt like, I'm anxious. How do I get rid of this? Why am I this sort of person? Should I have taken a beta blocker? This is the conversation you're having with yourself. The moment you just become willing to feel it as the pure energy of the physiology of cortisol release, it ceases to have any meaning. It ceases to be a problem in that moment, because it's no more-- it no more maps onto the kind of person you are then a feeling of indigestion or a pain

01:34:22 in your knee maps onto the kind of person you are. It's just sensation, anyway. Back to the main point here, which is that, if you train your attention in this way to notice the particularities of sensory experience and emotional experience, you're looking for the atoms of experience. You get better and better at that and certain things happen. But one thing that I really do think happens is there's a kind of frame rate change in the data stream where you really are just-- you're just noticing much,

01:35:00 much more. All of that is a very interesting way of training. It's not what I tend to recommend now. It's a great preliminary practice for what I do recommend, because it really teaches you the difference between being lost in thought and not, it really teaches you what mindfulness is. But it tends to be done by 99.9% of people in a dualistic way, which, again, you're set up to think, OK, I'm over here as the locus of attention. And I'm continually getting distracted by thought. And the project is to not do that anymore and actually

01:35:39 pay attention to the breath and sounds and sensations. And every time I get lost in thought, I'm going to go back here. But this whole dance of I'm lost in thought, now I'm strategically directing my attention again, all of this seems to ramify this sense of self. The of there's one to be doing this. There's somebody holding the spotlight of attention and getting better at coming back to the object of meditation. Again, it's inevitable that 99.9% of people are going to start there and stay there

01:36:15 for some considerable period of time. But the thing I like to do when I talk about all of this is undercut the false assumptions that are anchoring all of that as early as possible, because where, I think, you want to be is recognizing that there is no place from which to aim attention. This whole dualistic setup of subject and object is the thing that is already not there. And it's not that it's there and you meditate it out of existence successfully. It's really not there. And if you learn how to look for it,

01:36:50 you can see that it's not there and feel that it's not there. And it no longer seems to be there. It's like it's not-- and it becomes like, again, like a bi-stable percept where you looked at it long enough and you thought, OK, now I see the vase and the face and I can't unsee it. And every time I look, it's there again, right? So yeah. So to come back to the example you gave with your colleague at Stanford whose book I know I have. I haven't read it. This is a-- he wrote a book, Projections. ANDREW HUBERMAN: Yeah.

01:37:28 SAM HARRIS: So it's on my stack to read. But it's the opposite-- what I'm recommending is, essentially, the opposite end of the continuum of the internal exercise he was doing. So rather than-- so he's doing something very deliberate and controlled, and he is deliberately thinking in complete sentences and commandeering the machinery of thought and attention in a way that I would imagine. I mean, I'd be interested to talk to him about it. But I would imagine, he really feels like he's doing that.

01:38:07 ANDREW HUBERMAN: He's an engineer-- as you've describe it in this way, it reminds me, he's a physician, but he's also an engineer. So it's really about taking the raw materials of thought and engineering something structured from it. SAM HARRIS: Right. Right. ANDREW HUBERMAN: I haven't been in Carl's mind. SAM HARRIS: Yeah. But if we got him talking on that, I'm sure we would get a sense of what it is. ANDREW HUBERMAN: We'll do that conversation at some point. It's the exact opposite of what you're describing.

01:38:32 SAM HARRIS: Exact opposite would be to recognize that the sense of control is a total illusion. Because you don't know what you're going to think next. And even he, in the most laborious way, I mean, he could just get as muscular as he wants with it. He still doesn't know what he's going to think next. Because thoughts simply arise. You can run this experiment for yourself. And this connects up to the topic of free will which we might want to touch. But I mean, just think of any category of thing.

01:39:10 If I asked you to think of the names of cities or of friends you have or of famous people you can remember exist or think of nouns or anything. And just watch what comes percolating into consciousness right now. There are things you can't think of, there are things you don't know the name of. There are languages you don't speak, there are famous people you've never seen or never heard of. So you have no control over that part. Like those names and faces are not going to suddenly come streaming into consciousness.

01:39:48 But the totality of facts and figures and faces and names that you do know, only some will come vying for inclusion. And there's a sort of-- we could make guess and we know

something about the neurology of this. But you depending on what channel you're waiting for thoughts in, I mean, it's going to be different if it's visual or semantic or episodic memory. I mean, all of these things are different. But wherever you point your inner gaze of attention and wait for the next face or name. Certain things are going to come and certain things

01:40:32 aren't going to come. And how you land on one-- there'll be this process if you're paying attention, you might think, let's say we go with names of cities, right? So you'll think of Paris, you'll think of London, you'll think of Rome, you'll think of Sedona. So these names will come. And if I ask you to just say one, right? So just-- ANDREW HUBERMAN: Minneapolis is what came to mind. For me, it was very straightforward. It was Minneapolis, the famous person was Joe Strummer and they just like--

01:41:00 I can give you reasons why I think those came to mind. Recent conversations. SAM HARRIS: OK. So we know a fair bit about much of this. So one, we know that your reasons, obviously, could be right or wrong. They're very likely to be wrong because we have this confabulatory storytelling mechanism even in an intact brain where we just-- we seem to never lack for the reasons why something came to mind, and we can know we can manipulate people in ways that prove that people are just reliably wrong and confident.

01:41:33 You know, confidently so about the reasons why they thought of things or did things. But leaving that aside, even if you're completely accurate, there are people's names who you know and cities names that you know that inexplicably just didn't come to mind. And if we ran this experiment again and again and again, they wouldn't come to mind if your brain was in precisely the state it was in a moment ago. If we could return your brain to the state it was in a moment ago, correcting for all the deterministic changes and all

01:42:03 the random changes that would have to be corrected for, it to just get-- all the synapses and the synaptic weights and everything in the state it was in to produce Joe Strummer in Minneapolis. If we rewind that movie, that part of the movie of your life, you are going to say Joe Strummer in Minneapolis a trillion times in a row. So this is why, in my view, the notion of free will makes absolutely no sense. And you can add as much randomness to that process as you want. It still doesn't get you the freedom people think they have.

01:42:34 There's another conversation to have about why none of that matters and why things only get better once you admit to yourself that free will is an illusion. And yes, you can get in shape and you can diet and you can do all the things you want to do and you don't have to think about free will. But from a contemplative, meditative point of view, the thing to notice is that everything is just springing into view. There's no place from which you are authoring your next thought, because you would have to think it

01:43:03 before you think it. Like there is just this fundamental mystery at our backs that is disgorging everything that we experience. ANDREW HUBERMAN: What if I'm speaking? So if I'm talking about something and I have some command of that information, I can often sense what I'm going to say next and then find myself saying it. And hopefully, that's what they say and not something else. I certainly said things I didn't intend to say or never thought I would say in life. But when engaged in speech or action,

01:43:35 it at least gives us the illusion, I think, that we somehow have more command over our thoughts. SAM HARRIS: Yeah. Well you have a script. I mean, it's like there are things you know a lot about and you've talked about them a lot, and you know you have the things you want to say about those things and the things you don't want to say or you wouldn't want to say. And you know you can-- it still is a bit of a high wire act, because you can misspeak or you can fail to get to the end of a sentence in a grammatically correct way.

01:44:04 And again, all of this-- objectively, this whole process is mysterious to you. You don't know how you follow the rules of English grammar. Like your tongue is doing it somehow and when it fails, it fails, and you're just as surprised as the next guy that it failed. And you mispronounce a word, and OK, I don't know what happened there. But if it keeps happening, I'm going to worry I had a stroke. And if it stops, I'm not going to worry about it. So it's still mysterious even when you're doing it in a very rote, deliberative, and repetitive

01:44:46 way. But when you're talking about something you've talked about a lot and you know where you're going to go, right? We have many conversations like this, it is somewhat analogous to like a golf swing. Where it's like, you know how you want to do it, it's going to be all kinds of errors that are going to creep into your execution of it in real time. But there's like you, basically, have a pattern. And so you have certain linguistic patterns which you're following. Again, none of this is a proof of free will,

01:45:21 but I will grant you that phenomenologically, it feels different than just waiting for the next thought to come. But my point is that, even if you are-- I mean, you can trim it down to the simplest possible thing. Like you take two things you like to drink. You like coffee and you like tea. And you're deciding which to have. Both are on offer. You've got two cups in front of you. And the question is, here I've got water and I've got coffee, which am I going to drink next? Incredibly, it's as simple as possible decision.

01:45:58 And no matter how long I make this decision process, I could literally sit for an hour trying to figure out which to reach for next. And I could have my reasons why, and I could have all my

self talk. There's going to be a final change in me that's going to be the proximate cause of me deciding one over the other. And that, no matter how laborious I can make it seem in terms of my reasoning about it, it is going to be fundamentally mysterious as to why I went with one rather than the other. Whatever story I have--

01:46:36 because it's like-- it's still going to be as mysterious as you thinking of Joe Strummer when you absolutely-- you know of the existence of Marilyn Monroe just as much. And yet she simply didn't occur to you. It's fundamentally mysterious. Like there are people who are even more famous than Joe Strummer to you. I mean, I'm sure he may be somebody who you have thought a lot about, but there are people who like if we could just inventory your conscious life going back the last 10 years, there are people who you've thought about more than Joe Strummer

01:47:14 yet they didn't appear. And that is mysterious. And they could have, but they didn't. What I'm saying is that this mystery never gets banished in our experience. Whatever stories. We have to tell about it. Because if the story is, oh, well, I went for the water because I think I've been drinking too much coffee. I listen to Andrew Huberman's podcast and he was talking about caffeine, and I think-- ANDREW HUBERMAN: It's good for us, but you don't want to overdo it. SAM HARRIS: Yeah. ANDREW HUBERMAN: Yeah.

01:47:46 SAM HARRIS: OK. So let's say that is, actually, the causal chain. Like, I listen to your podcast, you say something about caffeine, now I'm self conscious about my coffee intake. But that's just adding a couple of links to the chain. There's still this fundamental mystery of, well, why did I find that persuasive? And why did I find it persuasive now and not five minutes ago when I was drinking the coffee? Like why did I just remember it now, or why was it effective? You only have-- your experience in every moment

01:48:19 is precisely what it is and not one bit more. And this subsumes even moments of real resolve and effort and picking yourself up by your bootstraps and changing everything. It's like you're on a diet and you're tempted to eat chocolate. And you think you're about to reach and say, no, I'm not breaking this diet. This diet is actually going to stick. Why did that arise in that moment and not at this analogous moment on your last diet? And why did it arise now to precisely the degree that it did? Why will it be as effective as it

01:48:58 will be and have the half-life that it will have and not 10% more or less. All of those are always mysterious to you. ANDREW HUBERMAN: Well, could we give, as we did before, an evolutionary and a developmental explanation? An evolutionary explanation might be that directed attention and action is metabolically demanding. It would be inefficient or impossible for us to be in constant, deliberate action with access to all the relevant information as to why we would do anything. So our ideas, literally, spring to the surface

01:49:33 at the last possible moment in order to offset the great metabolic requirements of having ideas that are related to goal-directed action or that goal-directed action is expensive. That's one idea. The other idea would be-- and we know this as a fact, which is that, initially, the brain is fairly crudely wired. That's not true within the neural circuits that control breathing, heart rate, et cetera, but within the neural circuits of sensory perception, thought, et cetera. They're fairly crudely wired.

01:50:01 And then across development, there's a progressive pruning back and also in parallel to that, a strengthening of the connections that underlie directed action and thought. And here, I don't mean directed as in free will, I mean, just that I can decide to imagine an apple and imagine that apple, for instance. SAM HARRIS: Right. But your decision-- ANDREW HUBERMAN: There seems to be some maintenance of the fine random wiring in systems. I mean, we've seen this even in worms, in flies, in so-called lower invertebrates and lower

01:50:35 vertebrates. And we see this in humans. And it seems to be that there's a lot of background spontaneous activity. I mean, I've sunk electrodes into the brains of humans, macaques, carnivores, and mice. And in every case, most of what you hear is called hash and it has nothing to do with hashish. Is just [VOCALIZING] on the audio monitor which is picking up a bunch of action potentials. As you're listening to a chorus of action potentials. But it's rare to find a neuron that faithfully [VOCALIZING]

01:51:02 fires to represent some sensory stimulus in the world. And you can arrange that marriage experimentally so that you can arrive at those strong signal to noise events. But I was always struck by how much noise there is in the system all around all the time. And people argue, is the noise really noise, et cetera? There's still a lot of debate about that. But I can imagine that some of the spontaneous nature of thoughts just relates to the fact that there's a lot of background spontaneous activity

01:51:29 in the brain. Now, why that is a whole other discussion. But if I were to set up two constraints that there's a lot of spontaneous activity, it's going to generate random thoughts. Thankfully, not much random action, although there's a little bit of random action in our daily lives. And then against that say, well, any deliberate thought or motion is going to be expensive. It's a metabolically expensive organ to begin with. And so you just have to-- evolution has arrived at a place where spontaneous geysering up

01:52:00 of things upon which like deliberate thoughts and action are superimposed is the best arrangement overall for this very metabolically demanding organ. I mean, what I basically gave

was just kind of a biological description of just one narrow aspect of it. But can we get comfortable with that? And the reason I say get comfortable is that I'm-- and here, admittedly, I'm forcing a little bit of a striptease towards what I think I and everyone else wants to know, which is how to meditate and why, in particular, meditation convinces us

01:52:31 that something doesn't necessarily have to be eliminated, but that was actually never there. I feel like we've now set up a sort of almost like a-- you're not contradicting yourself by any means, but in my mind, there's a contradiction. And here's the contradiction. I love this statement that meditation over time or done properly reveals to us that we're actually not trying to make the gap between actor and observer go away. It was actually never there. To me, that's one of the more important statements

01:53:01 that I, perhaps, have ever heard. And it inspires me to go further down this path of meditation, because I've never experienced that. SAM HARRIS: Right. ANDREW HUBERMAN: Not deliberately, and certainly, not through meditation. If I ever experienced it, it was transient enough that I'm intrigued to experience it more. So on the one hand, you're telling me something was never there. And there's a profound experience to be heard by anyone that's willing to do the work to arrive at that experience of the loss of that illusion.

01:53:28 On the other hand, I'm hearing that there's a profound gap that really does exist, which is that we believe that our thoughts are somehow from us. And indeed, they're from in the cranial vault someplace, maybe, in the body a bit as well. But that we over attribute the degree to which we are that and that is us in a way that's volitional, that we control. And so once I'm hearing that there's something-- there's an illusion that we can eliminate and on the other hand I'm hearing that there's an illusion that we can't

01:54:07 eliminate, and maybe these are unrelated and I'm bridging them in an unimportant way, that seems only important to me. But somehow, I can't resolve these two and maybe the thing to do then is, can we separate them in terms of a practice to witness them? That would allow us to resolve them separately. SAM HARRIS: Right. So I think I'm hearing the problem. There's this-- let me bracket the whole free will discussion because it really is the flip side of this coin that I'm-- the obverse of which is the illusion of the self.

01:54:45 ANDREW HUBERMAN: So at least-- I might be on the right track. SAM HARRIS: Yeah. Yeah. ANDREW HUBERMAN: They are the opposite sides of a coin. SAM HARRIS: Yeah. Yeah. ANDREW HUBERMAN: OK. Great. Because to me they seem very different in essence. SAM HARRIS: No. Because what I'm calling the sense of self and what I think most people feel as their core sense of self is this feeling of-- I mean, it's the feeling of being the locus of attention, but it's also the feeling of being the locus of agency.

01:55:10 I can do the next thing. Like, who's doing this? Who's reaching for the cup? I am. Right? I intended this, and now I'm doing the thing. And my conscious intention is the proximate cause of my reaching, right? And so I'm the author of my thoughts and actions, essentially. And my specific uses of attention, right? So I can pay attention to the breath, I get lost in thought, I come back to the breath. But on some level, the thoughts themselves are more of my doing something with almost authorial intent.

01:55:50 Like I'm thinking like, what the hell is this guy talking about? Who's thinking these thoughts? I am. The person who really doesn't get what I'm saying is thinking something like that. What the fuck is this guy talking about? I know I'm here. I'm a self, I'm a body, I'm a mind. I can reach for things. That these intentional actions are different from things that happen to me. A voluntary action is different from an involuntary one. So having a tremor is different from consciously deciding to pick up a glass.

01:56:25 So obviously, everything I'm saying about meditation and the self and free will in order to be a sane picture of a human mind and of reality has to conserve the data of experience such that, yes, I can acknowledge the difference between a tremor and a deliberative voluntary motor action. And the things you do volitionally are different not just psychologically and behaviorally, but they just have different implications for like in a court of law. You accidentally hit someone with your car or you did it on purpose, that's still

01:57:02 a distinction that matters. Importantly, it tells us a lot about the global properties of your mind such that we have a sense of what you're likely to do in the future. If you're someone who likes running over people with your car, you're a psychopath who we need to worry about. If you're someone who did it by accident, well then you may be culpable for the level of negligence that allow that to happen. But you're a very different person and we you differently and we're wise to. So anyway, we can bracket all of that.

01:57:32 There's this-- I mean, there are some fundamental-- there are some false assumptions about the underlying logic of this process, which, I think, is worth addressing. Is actually-- there was a kind of found object in the news that I talk about at one point. I forget where it is in Waking Up app. But there was a story that I stumbled on the internet. I think it's about 12 or 13 years old. Of a tourist bus in-- I think it was in Norway. It was somewhere in Northern Europe. And it had about 30 people on it.

01:58:11 And one person was described as an Asian woman. And they went to a rest stop and everyone got off the bus. And shopped and had lunch. And this Asian woman changed her clothing

for whatever reason. And they all got back on the bus. I think the relevance of it being an Asian woman is that there were language barriers that explain what later happened. So everyone gets back on the bus, the Asian woman has changed her clothing. And the bus is about to leave but then someone notices, hey, there was an Asian woman who got off the bus who isn't--

01:58:46 it hasn't come back yet. And they tell the driver this. And this poses a problem. So now everyone's waiting for this person to return. But in fact, everyone was on the bus. This woman had just changed her clothing, and was not recognized by her fellow travelers. So everyone gets concerned as this tourist doesn't show up. And they start looking for her. And they can't find her. And so a search party is formed. And the Asian woman, because of whatever language barrier, heard that there was a missing tourist,

01:59:20 so she joins the search party, which, in fact, is looking for her. And this goes on into the night. And they're readying helicopters for a dawn patrol to find the missing tourist. Now, at some point along the way, I think it was at like 3:00 in the morning, this tourist realizes that she is the object of this search. And obviously, the whole thing unravels. She confesses that she changed her clothes and the problem is solved. But the problem is not solved by the logic that the seeker is expected.

01:59:56 So it's like, it's not true to say that the missing tourist was found in the way that was expected. Because a missing tourist was never lost. The missing tourist was part of the search party. So when you think about it from her point of view, like what happened, she's part of the search party. She's looking for the missing tourist not knowing that she, in fact, is the missing tourist. So what happens at the moment she realizes that everyone's looking for her? The search isn't consummated in the way

02:00:32 that is implied by the logic of everyone's use of attention. And yet the problem evaporates. And there's something deeply analogous about the structure of that and the meditative journey. Precisely in, again, not talking about all the possible changes in the contents of consciousness that could be good, which, again, they come along for the ride anyway when you do the thing I'm talking about. It's on this point of looking for the self and not finding it. And there is this sense that, OK, the self is here,

02:01:10 and it's a problem. It is the string upon which all of my conscious states, mostly unhappy ones, are strong. It's the thing that is at the center of my anxiety. It's the thing that I don't feel good about. It's the thing that when criticized, I let implode. It's the center of my problem, and now I'm trying to feel better. And meditation has been handed to me as a possible remedy for my situation. And it's billed as a remedy. And in fact, I'm hearing from this guy that this is the thing that is going to cause me to realize

02:01:47 that my self isn't where-- or as I thought it was. So now I'm going to look. And so again, the sense is, I start out far away from the goal here. I start out with a problem. I'm now meditating on the evidence of my enlightenment. I can feel my problem. I feel that I'm distracted and distractible. And I feel as this sort of cramp at the center of my life, that's me. And I'm not as happy as I want to be, I'm not as confident as I want to be. I'm more distractible than I want to be. And now, I'm paying attention to the breath.

02:02:25 This is what the search party feels like. This is what the confused tourist feels like in her own search party. And she's looking for the missing person. So the angle of-- the inclination of all of this is-- and the logic of it is all wrong, understandably so, given how we all get into this situation. But it's useful to continually try to undercut it and recognize that the thing that's being looked for is actually right on the surface, which is, there is no one looking. There is no place from which you are--

02:03:10 if you're paying attention to the breath or to sounds or noticing the next thought arise, this sense that you are over here doing that thing is actually what it's like to be thinking and not knowing that you're thinking. There's an undercurrent of thought that's going uninspected in that moment. And so there is just-- there's a continually looking for the mind, looking for the center of experience, looking for the one who is looking, which, again, which is the orienting practice here. And there's a lot more I say about this, obviously,

02:03:47 over waking up. But it's the experiment you have to perform in order to get ready to recognize that the search party was formed in error, essentially. And the problem that you're trying to solve with this practice does evaporate in a similar way, which is like, you don't actually get there in the way that you're hoping for. It's like you drop out the bottom of this thing in an unexpected way. There's actually another similar parable or anecdote that I don't remember if it's Zen or Sufi or-- I mean, I'm sure it's been re-appropriated

02:04:30 in many different ways or by many different traditions. But the case of somebody who's lost in a town and they're asking for directions and you can put this in Manhattan. Let's say, you're wandering Manhattan and you're a tourist, you don't know where anything is. And you stop and ask someone, where is Central Park? And the person thinks for a second and they says, oh, yeah. Unfortunately, you can't get to Central Park from here. Now, that is a very strange-- I mean, you think about that for a second.

02:05:00 You realize, OK, that's an absurd. There is no place that you can't get to from the place you're starting on Earth. ANDREW HUBERMAN: A failure to describe the physical

relationships between anything in the world. SAM HARRIS: Yeah. That's just not the world we live in. So but it's a funny thing. But on some level that is true of meditation. It's like you can't get there from here. The sense of view as subject isn't brought along to this thing you're looking for. It's almost like you're making a fist

02:05:38 and you're trying to get to an open hand. The fist doesn't get to take that journey as a fist. The fist doesn't go along for the ride. The fist comes apart. And on some level, the subjectivity is an attentional fist. It is a contraction of energy. Again, it's so much bound up and thought for most of us, most of the time. And when properly inspected, there's just this evaporation of the starting point. But there's not this fulfillment of, I'm going to get-- this fixed is just going to-- if life gets good enough, if I get concentrated enough,

02:06:27 focused enough, if I austere enough, if I renounce enough, if I desire less, if I-- with enough good intentions, this fist is going to move into some sort of sublime condition. That's not the logic of the process. ANDREW HUBERMAN: I really appreciate these models and analogies for conscious experience both as most people experience them and harbor them and as a way to frame what's possible through a proper meditation practice. I do want to talk about what a proper meditation practice looks like a bit.

02:07:05 But at some point, I do want to raise a model of, maybe, even just perceptual awareness to see if it survives the filters that you've provided. But first, briefly, and then we can return to it. What does this meditation practice or set of practices look like? Obviously, the app is a wonderful tool. I've started using it. As I mentioned at the beginning, my father's been using it for a while and many people have derived great benefit from it. But if we were to break it down, meditation into some basic component parts as we have broken down

02:07:47 normal perceptual experience in some of its component parts-- SAM HARRIS: Yeah. ANDREW HUBERMAN: --I can just throw out some things that I associate with meditation, and maybe you can elaborate on how these may or may not be applied. For instance, there is almost always a ceasing of robust motor movement. I know they're walking meditations and so forth. But it seems like sitting or lying down and, perhaps, not always but often limiting our visual perception, closing the eyes. SAM HARRIS: Right.

02:08:19 ANDREW HUBERMAN: Directing a mind's eye someplace. Is there a dedicated effort toward generating imagery? What are the component parts? And where I'm really going with this is, why would those component parts, eventually, allow for this dissolution of the fist or the realization that there is no distinction between actor and observer and so on. SAM HARRIS: Yeah. Yeah. Well, so to answer the second question first, ultimately, meditation is not a practice that you're adding to your life. It's not a doing more of anything.

02:08:54 It's actually ceasing to do something. It's ultimately non-distraction. I mean, ultimately, you're recognizing what consciousness is like when you're no longer distracted by the automatic arising of thought. It's not the thoughts don't arise, it's not that you can't use them, it's not that you become irrational or unintelligent, I mean, all of that-- you still have all of your tools, but everything is in plain view. I mean, there's an analogy in Tibetan Buddhism which I love, which is you're kind of in the final stage of meditation,

02:09:30 thoughts are like thieves entering an empty house. There's nothing for them to steal. So in the usual case, thoughts are-- there really is something in jeopardy. Every time a thought comes, I'm not meditating anymore, and not only that, I feel terrible because of what I'm thinking about most of the time. And so it's totally understandable that thoughts seem like a problem in the beginning. And for certain types of meditation, they are explicitly thought of as a problem because you're trying to focus on one thing

02:10:02 to the exclusion of everything else, including thought. And that is what I called the concentration practice earlier. And that's a training that can be good to do. It becomes a tool that you can use for other kinds of insight. But it's a very specific and it's kind of brittle skill in the end. I mean, it's a skill. Just like I'm going to pay attention to one thing and I'm going to do that so well that everything else is going to fade out. And it's somewhat analogous to what you described in the visual system.

02:10:33 If have a laser focus to one fixation point, everything else in your visual field begins to fade out. But meditatively, if you have a laser focus on any one thing, whether it's the breath or a candle flame or whatever it is, not only does-- I mean, let's use the breath for a second. Because your eyes can be closed. I mean, you can lose all sense of everything. I mean, you can lose all sense of hearing and your physical body can disappear. I mean, like, literally, it can become incredibly subtle

02:11:09 and vast and drug-like. And many people approach meditation thinking climbing the ladder of those changes into subtlety and vastness, that's the whole game. And it can be a deeply rewarding game to play. And it also does come with all kinds of ancillary benefits. I mean, all the focus and the calm and the smoothness of emotional states. I mean, all of that comes with greater concentration. And it can be quite wonderful. But again, at best, that's a tool to aim in the direction that I'm talking about now with respect to meditation,

02:11:49 which relates to more what I would call mindfulness generically. And ultimately, non-dual mindfulness. So mindfulness generically and for most people, certainly in the beginning,

dualistically is just the practice of paying careful attention to whatever is arising on its own. Now in the beginning, it's natural to take a single object like the breath as a starting point. It's an anchor. But very, very quickly, over the course of even your first week of doing this, teachers and various sources of information

02:12:32 will recommend that once you get some facilities-- once you know the difference between being lost in thought and actually paying attention to the breath, well, then you can open it up to everything. You can open up the sounds and other sensations in the body and moods and emotions. And even, ultimately, thoughts themselves. So very quickly, you can recognize that thoughts are not intrinsically the enemy to this practice. They are also just spontaneous appearances in consciousness that can be observed.

02:13:04 But for some considerable period of time, people will feel that there is a place from which that observation is happening. There's just, I'm now the one who's being mindful. And however attenuated that sense of self can be, I mean, again, it can get very expansive. I mean, you can lose-- as you get anything, just a modicum of concentration, you know it becomes very drug-like and you get the boundaries of your body dissolve. And your feeling of having a body can disappear. And you if your eyes are closed, you know your visual field--

02:13:43 I mean, most people, when they close their eyes initially, they just forget about their visual field. But if you close your eyes right now, you notice your visual field is fully present. And we call it dark, but it's not quite dark. There is a sort of scintillating some field of color and shadow that's there in the darkness of your closed eyes. And that can become a sky-like domain of vast visual expression that opens up as you get more concentrated with your eyes closed right. So you can very much be aware of seeing with your eyes closed

02:14:25 in a meditative practice. But from the point of view of mindfulness, the logic is not to care about any of the interesting changes and experience that come as a result of practicing in this way, because the underlying goal is to be more and more equanimous with changes. So it's not to grasp at what's pleasant or interesting and not to push what's unpleasant or boring or otherwise not engaging in a way. What you want is just a kind of a sky-like mind that just allows everything to appear. And you're not clinging to anything

02:15:09 or reacting to anything. ANDREW HUBERMAN: Could I ask you what your thoughts are about the differences between nouns, adjectives, and verbs in the context of what we're talking about in you're describing? And the reason I bring this up is that as you know, I know everything in biology is a process. We would never ever say, oh, the perception of that red line on a painting is a noun. I mean, it's an event in the visual system. You're abstracting some understanding about that thing in the outside world.

02:15:44 And I think it's very useful in thinking about the brain. People will notice I notice-- I, excuse me, actively avoid the use of the word mind, because I figure, especially, with sitting across from me, that I'll step in it if I do. But the brain generates a series of perceptions or what have you by through processes, not nouns. And so when thinking about biology, I think of development is an arc of processes. Aging is an arc-- perception is an arc of processes. They just exist on different time scales.

02:16:17 And so a little bit of what I'm hearing is that inside of an effective meditation practice, there's a little bit of certainly non-judgment but discarding of the noun and the adjective modes of language. Like red apple. OK. It's a red apple, but then you need to eliminate some other adjectives about it. It's a rotten apple, it's a ripe apple. And instead view the appearance and disappearance of that apple as just a thing, a process as opposed to an event. And now, events, we could really get into the language aspect of it.

02:16:53 That just reveals how diminished language is to describe the workings of the brain at some level. I don't know if any of these resonates. But it seems to me, the goal or one of the goals is to start to understand the algorithm that is the fleeting nature of perception but to not focus on any one single perception. And then to not even focused on one single algorithm, but to, at some level, there's a-- what is revealed to the meditator over time is some sort of macroscopic principle about the way perceptions work at a deeper level.

02:17:30 That there's a deeper principle there that sits below our-- certainly our normal everyday awareness. But that in paying attention to the mechanics of all this stuff and not judging those mechanics, not naming those mechanics, or just naming them and let them pass by. That there's some action function, some verb is revealed. And that maybe that verb-- may be the word to describe that verb is mindfulness. Maybe mindfulness is really just a verb to describe that. I don't know. Is there anything here?

02:17:59 Or am I-- I don't know if I'm creating just like useless straw or if there's actually a seed here of something real. But to me, any time I want to understand something in biology or psychology, I try and broaden the time domain and think in terms of verbs, not nouns or adjectives. SAM HARRIS: Yeah. Yeah, yeah. No. That's very useful, and that's somewhat adjacent to this distinction I'm making between dualistic and non-dualistic ways of experiencing the world. So even dualistically, everything is still a process.

02:18:30 And we're misled by the reification that noun talk gives us. And this applies not just to something like mindfulness, but even to something like the self. So the sense of self is also a

process. I mean, it's a verb, it's not-- so we're self in more than we are ourselves. And there are-- even appropriate uses of the term self that don't go away even when you recognize that the core subject, self, is an illusion. There are states of self where you can recognize in your life that you inhabit very different modes of being depending

02:19:16 on the context. So like there are moments where you-- just by walking into a certain building, you suddenly transition into a different state of self. Like suddenly, you pass through a door and now you are a customer in a store, right? So we know what that customer feeling is. Like, you're now the person who's getting the attention. It's a very formalized type of attention from the person who is running the store or a restaurant. You're a customer at a restaurant. That's a-- I just remembered something that's funny.

02:19:49 That was born of a mismatch of this. I'll come back to that in a second. So there are-- so we go through it. You can be a student in the presence of a teacher, you're going to be a parent in the presence of a son or a daughter, you can be a spouse in the presence of your spouse. And all of those shadings of-- like the change in context really does usher in some fundamental psychological changes in just the states of consciousness that are available to you. And some of this is really-- I mean, I'm sure we could understand a lot about this

02:20:33 personally and generically. But it is pretty mysterious. I mean, there are people who I know who I'm with them in a certain way, and based on something I'm getting off of them, I can't be that-- I'm effortlessly one way with them, and there's no way I could be that way with somebody else. I don't know if it's the pheromones or their facial, just the way they are, their facial expression. But I mean, there are people with whom I'm really kind of effortlessly funny, and there are people with whom I couldn't even--

02:21:11 it would never occur to me to be funny no matter what happened. And I have long standing relationships with these people, so all of that's very mysterious. But anyway, the difference there is not in this core sense of subject in relationship to all the objects, it's in kind of the states of self. And all of that is very verby. All this is a pattern of changes. It's a pattern of what's available and what's not available, the capacities there that come online or not in those various contexts. But no, the memory I just had, which

02:21:50 I hadn't had in a long time. But it was one of these moments where I realized the power of these shifts in context for states of self. So once, I was a young man. I think I was probably 22 or so, and single. And like, you're just like, trying to figure out how do you meet women? And how does one get confident to do this well? And I walked into a restaurant and a kind of a woman was walking toward me, toward the front door of the restroom. But she was walking toward me in a way where I just by default

02:22:33 assumed she was the hostess in the restaurant. But she wasn't the hostess, she was just someone who had just eaten there, I guess. So I walked through, and she comes out. And so there's a fundamental misunderstanding in me that's set up by literally just this change in architecture. And so I just said hi to her in a way that I presumably I would say hi to any hostess who was coming up to ask me where I wanted to sit. But what had actually happened is I had said hi to a total stranger in a way that I tended at that point never

02:23:06 to say hi to total strangers because I was shy and it was just like that. But apparently, I gave her like a 10,000 watt high of all of the confidence you would have if you were that sort of person. And it just ushered in a complete like-- so I went to my table, and this woman, I came back into the restaurant and gave me her phone number, which was something that was just a completely foreign experience to me, and it was based completely on my misunderstanding of the situation I was in. And so anyway--

02:23:39 ANDREW HUBERMAN: Among the misunderstandings that one can have and then action and engage in life, I would say that was a somewhat adaptive one. SAM HARRIS: Yeah, but then you realize that, OK, but then there are certain people who recognize this machinery to whatever degree or have kind of natural aptitudes for bringing certain things online or not such that they can consciously make these states of self, this level of gregariousness, say, available to them in the circumstances where it's is actually useful to them.

02:24:12 So if you're single and you want to meet people, well, it's actually very helpful to feel confident enough to just go say hi to strangers and ask them how they're doing and to be online in that way. Where at that point in my life, in that circumstance, by default, I was going to ignore this stranger who I was passing by in the doorway of a restaurant. But thinking she was the hostess, I was engaging her fully. So anyway, you can consciously-- again, this does not invoke free will at all. But yes, you can consciously decide

02:24:46 to play with these mechanisms such that you can decide what states of self would be more normative to have given what you want in life. And you can become increasingly attentive to the ways in which you get played by the world. You're a kind of instrument. Your mind is a kind of instrument. Your brain is a kind of instrument that is continually getting played by the situations you are in, and you can become more of an intelligent curator of your conscious states and your conscious capacities just by noticing the changes in you.

02:25:21 Like, in graduate school, it's something I talk about. I think at some point in waking up, this became very stark for me because I was an old graduate student. I had taken 11 years off at

Stanford between my sophomore and junior year. So when I went back to school-- ANDREW HUBERMAN: Talk about a leave of absence. SAM HARRIS: Yeah, but I mean, Stanford had this, you might know this. They have this stop out policy where you never really drop out, you just stop as you want. You can always go back.

02:25:50 You don't have to write letters saying that you still exist every two years as you do in other schools. So anyway, I showed up after 11 years. So I was really on a deadline, and I felt late for everything. So I'm kind of finishing my degree as quickly as I can as an undergraduate, and then I jump into graduate school, and I'm an old graduate student. There's a real sense of urgency. Like, I'm late. I should have done this earlier. I want to get this stuff done. But then 9/11 happened. And just as I had finished my coursework getting my PhD,

02:26:26 and I was just getting into my research but 9/11 intersected with my life in such a way that I just had to drop everything and write my first book. And I did that. And then I just had to drop everything and write my second book because of the response to the first book. And so essentially, I had like, four years, where I was AWOL doing my PhD. But I still had a toe in the lab and I was still showing up occasionally. But I was becoming this kind of cautionary tale from the point of view of grad school,

02:26:53 but I was also becoming kind of a famous or semi-famous writer because my first book had been a New York Times best seller, so I was getting some notoriety as a writer. And so I was doing things like, I was giving a Ted Talk but I still hadn't finished graduate school. So it was I think that timing's is right, maybe I had just finished graduate school when I gave the Ted Talk. But anyway, so I was rowing in two boats and one boat was sinking or showing every sign of being damaged. And I was literally like, getting letters

02:27:26 from the head of the department saying, we're concerned about you. But on the other hand, I was becoming a quasi celebrity in that world too, at least in a world that was overlapping. So I was having the experience of going in the moment where this crystallized for me in a fairly peculiar way was, I had a meeting at like 3:00 o'clock with my advisor who was just this guy, Mark Cohen, in the brain mapping center at UCLA who's a fantastic guy. Great advisor. I did not extract as much wisdom from him as I should have.

02:28:04 Brilliant scientist. And for him, I'm late. At least, in my head-- he is not that he was riding me so hard but in my head, I'm very self conscious about how I'm not living up to his expectations at this point. So I have a meeting with him at 3:00 o'clock, and I'm just kind of wilting under his gaze and my own imagined inner gaze of his. But two hours later, I have a meeting with his boss, a dinner meeting with his boss who wants to meet with me to get advice on launching his book. We have the same publisher but I'm

02:28:43 like, the much bigger author at Norton, and he's coming to me for advice. And so I'm ricocheting between two diametrically opposite self states that are-- again, this comes down to architecture. It's literally like the state I was in walking into one building and then leaving and walking into another building on the same campus. And they were completely opposite self concepts. Like, in one context, I am a fuckup. In another context, I'm a celebrity. ANDREW HUBERMAN: And you have mastery and virtuosity,

02:29:22 and we're developing it very quickly. SAM HARRIS: But so again, this is a kind of a stark version of that. But everyone has some version of this just in bouncing between talking to their mom and then talking to their best friend and then talking to a stranger and talking to someone who's very successful, talking to someone who's not very successful. You notice your vulnerability to all of this stuff. And ultimately, what you want is a level of psychological integrity that is truly divorceable from that.

02:29:57 Now, I'm not I'm not saying you're ever going to get it perfect, there's always going to be some-- I mean, I can't talk about the ultimate fulfillment of this process. I'm not a Buddha, I'm not saying I've finished the project. But I think there's more and more as you become sensitive to these changes and you become sensitive to what it's like to actually not be psychologically reactive and not be definable by your own self-concept, your own-- you're not identifying with anything, you're not hanging your hat on anything,

02:30:36 you're not thinking about yourself in the kind of terms that you would export to others and then care about what they think about you. There's a kind of invulnerability that arises that's not borne of being well defended, it's born of being evaporated. It's like, you're no longer keeping score in those ways. ANDREW HUBERMAN: Once again, I really appreciate that description because these days, I'm really intrigued by something we've known for a long time that you're certainly familiar with is the prefrontal cortex's ability to establish

02:31:17 context dependent rule sets. A Stroop task would be basic example of reading numbers or letters on cards and then switching to having to report the colors that the letters and numbers are written in. It's a basic task. But prefrontal cortex, obviously important for setting context dependent thought and behavior and directed action. But within the context of all these different variations of the self, depending on graduate school or relationship where sitting alone in one's room, there are different rule sets arise

02:31:48 and somehow, we are able to have a coherent sense of self that encompasses all of those. Functional people can toggle between them as needed and not overlap them

inappropriately. At least not to the extent that it's career failing or life failing. Although there are sad examples of that, many of which exist in the Twitter space. I know several colleagues, not directly of mine, but people who threw mistakes made with their thumbs, where they forgot context or forgot to realize that the context on social media is near infinite.

02:32:25 But the context that existed in their head might not be clear in the way that they communicated something, and they lost their jobs by saying what were perceived as insensitive things. In some cases were, in fact, offensive, insensitive things. In some cases, it's debatable. In any case, I think that the image that now comes to mind relates to something you've said several times, that it's not about eliminating something, it's about revealing that something was never actually there. And then in terms of sensory experience

02:32:55 and these different aspects of the self, I have this image in my mind of-- I'm not an experienced scuba diver, but I've done enough of it. I've worn a wetsuit. You wear a complete wetsuit with the hood. And this idea if you were born into that wetsuit, you might think that yeah, you nudge up or lean up against a wall and you experience it one way. But were you to shed that wetsuit, you go, wow, there's this incredible landscape of somatosensory experience that I had no idea. It goes way beyond levels of sensitivity.

02:33:27 Right now you're talking about fine two point discrimination and light strokes, and this could be positive or negative pain in other ways too. But what you're describing is essentially that the wetsuit was never really there, but was created through a series of action steps. And I think what we're migrating towards here is a set of for most, non-intuitive or non-reflexive action steps that reveal to us that in fact, we're not wearing the wetsuit. Now, you raised one topic, which I think is analogous to this wetsuit, which

02:34:02 is this notion of distraction. That normally, distraction is masking what would otherwise be a better experience of life. I can think of distraction as falling into two different bins. One would be the kind of distraction that is internally generated. Like, the fact that thoughts arise and pull me down different alleyways and avenues of my brain and my thoughts and my experience. And that would compete with my ability to really focus on something. And then another form of distraction which captures my ability to focus intensely

02:34:41 but has me focusing on the wrong things. And here, I think the judgment of wrong is reasonable to include if, for instance, I'm being impulsively yanked to something on social media. I'm being impulsively yanked to someone else's pain and experience and somehow confusing that with my own experience. This isn't empathy but just being yanked around. My attention as a spotlight is kind of like over here, over there. I'm not feeling as if I'm the one standing behind that spotlight controlling it or I'm not the spotlight, just to keep with what

02:35:12 we've been building up here. So could you tell us a little bit about distraction and tell me whether or not these two forms are in any way accurate or inaccurate? I'd be happy for them to be inaccurate. And whether or not there are other forms of distraction that we need to be on the lookout for. And again, I think what most people are seeking is, what is the way to not just enhance our ability to focus but to shed this wetsuit-like cloak that limits our experience that I'm calling and that you've

02:35:41 called distraction? SAM HARRIS: Yeah, distraction is one component of it. The other aspect of it is identification with thought. And the feeling of self is bound up in the sense that I'm the thinker, I'm the one attending, I'm the one vulnerable. I'm the inner homunculus that's vulnerable to experience. And it can be gratified by it or not, and it's constantly trying to improve it or mitigate negative aspects of it. It's the sense that there's kind of a rider on the horse of consciousness as opposed

02:36:18 to just consciousness and its contents. So again, it rides atop this illusion of control, et cetera. So to go all the way back to the question you asked about, just what is in it, what I recommend as a starting point for meditation. Some of your assumptions are, in fact, true. Yes, I often recommend at the beginning people close their eyes and you do a sitting practice and it's different from a walk in practice. I mean, you can do both, but people tend to start sitting with their eyes closed. But again, ultimately where this is going

02:36:56 is it's not an art of-- meditation properly recognized is not an artifice that you're adding to your life. It's not even a practice, it is less rather than more. And therefore, it is also coincident with potentially every waking moment. There's nothing that you can do with your attention once you know how to meditate. That in principle excludes meditation because meditation is just a recognition of an intrinsic character of consciousness in each moment. And all you have in each moment is consciousness and its contents, whatever you're doing.

02:37:34 So in the beginning, you'll be very deliberate and precious about deciding to practice meditation, and you'll set aside 10 minutes in the morning, and you'll do that. And it'll seem very different from the next 10 minutes when you're spilling out onto your to-do list and you're trying to figure out what the day looks like. But ultimately, you want to erase this boundary between formal practice and the rest of life such that it's just not remotely findable. And that's achievable. And I think even from the very beginning,

02:38:13 you can relax this conceptual distinction between meditation and its antithesis, because it's not at the level of anything you're doing, it's at the level of what's happening in your

relationship to thought. Like, what can you notice? It's + transition from the by-stable percept. You're looking at the image and you see nothing. Let's say it's the Dalmatian, it's just the spots on the paper. And you don't see anything. And then all of a sudden the Dalmatian or the face of Jesus or whatever the image is pops out and then you see it,

02:38:54 it's the transition from nothing to something. The practice becomes the transition from being lost in thought and then waking up. And breaking the spell of thought, and identification of thought is very much like waking up from a dream and having-- it's like that transition. Like you're having a dream and couple of things are true there. I mean, it's a psychosis that is just not-- we don't problematize because you're safely in bed and you're not moving or unless you've got some kind of sleep disorder.

02:39:35 You're not walking around harming yourself or anybody else. But to be in bed and to not know it and to think you're running along a beach or you're getting tried for murder in a court of law or whatever the thing is that you're completely delusional about, that is psychosis. And it's like you're fundamentally unaware of your circumstance. And then two things can happen there. You can either become lucid within the dream, which is interesting, and there's a whole phenomenology of that which can be practiced.

02:40:07 But more commonly, you can just wake up from the dream and all of a sudden, the problem you thought you had is no longer there, and you have a completely different context for your conscious life. Now, you know you're safely in bed all the while. There really is something analogous when you break this identification with thought. You're having a thought that seems to be some kind of moral or psychological emergency and yet the moment you see daylight around, the moment you see that the mind is larger

02:40:50 than this mere appearance, then suddenly you have a degree of freedom that a moment ago was just unthinkable. And you recognize, you sort of come to in a way, you recognize your circumstance in a way that you weren't a moment ago when you were just talking to yourself, when you were just identical to that conversation. So this is all to say that ultimately, meditation-- I mean, so again, there's another apparent paradox here. Many people who don't know much about meditation will say things like, well, for me,

02:41:26 running is my meditation or skiing or rock climbing or playing the guitar or something they like to do that gives them an experience of flow, that's what they go to feel better and that's the opposite of all the chaos of their lives or their time on Twitter or whatever it is. And virtually every case, it's not true to say that that is effectively meditation. By learning to play the guitar, you're not going to learn what I'm calling meditation. And you're not going to learn it by cycling and getting-- no matter how good you get at any of those things,

02:42:02 you're not going to learn it by doing those things. But paradoxically, I mean, not really, but it can seem like a paradox. Once you know how to meditate, then you can meditate doing all of those things. Meditation is totally compatible with playing the guitar or skiing or doing any ordinary thing you like to do. So once you know how to meditate, and again, it's totally natural in the beginning to formalize it and to set aside time each day to do it because it is a training. I mean, it is something that in the beginning,

02:42:32 you have to get used to. But once you're getting used to it, then there is no good reason not to be experiencing this thing I'm calling meditation, this insight into the center looseness of consciousness, the non-selfhood of consciousness. You should experience it when you're playing your favorite sport or when you're having a conversation with somebody. Then to come back to your initial assumption about eyes closed, a lot of practice, even formal practice can be done eyes open. And it's important to do it as open

02:43:11 because so much of our anchoring of our sense of self is based on visual cues. I mean, we know that you can if you give people the right visual cues, you can translocate their sense of self. You can give them an out-of-body experience with a video display, where you can literally make them feel like there's a body swapping illusion. You can make them feel that they're in another person's body looking back at their body if you run the cameras the right way. ANDREW HUBERMAN: I've done this in VR, seeing an image of--

02:43:41 they create an avatar for you and then your bodily movements generate the movements of the avatar, and you start gaining presence as they call it in the VR lingo very quickly. And then pretty soon, you lose sense of your own bodily representation. And it's a little eerie. What's eerie is to me is going back into, of course never left, but back into your actual body when the VR goggles pop off. The world seems almost overwhelming the number of sensory stimuli that are in a laboratory room, which is actually quite sparse.

02:44:17 So exactly what you described, this translocation of notions of self through visual experience. SAM HARRIS: But conversely, when you lose the sense of self, the sense of self I'm talking about, it can be especially vivid and salient with eyes open. Because so many of your reference points to selfhood are delivered visually, especially in a social situation. So like, I'm talking to you, you're looking back at me. So the implication of your gaze is that I'm over here behind my face implicated by your gaze.

02:44:50 So the sense that you're looking at something is the sense of self in that social context. And if your facial expression changes, I'm saying something and if you kind of furrow your

brow, like, what the hell is he-- and I can read into that facial change, some interstate of yours that is salient to me. All of a sudden, we've got this sort of dance of. Like, I'm noticing you reacting to me, and that's changing the way I'm feeling about what I'm-- That's the purview of every neurosis everyone didn't want, right?

02:45:23 ANDREW HUBERMAN: And every relationship. I had a girlfriend when I was a post-doc who was very, very-- she was brilliant, really, still is. And she always said that every relationship, there are four arrows. She used to say she's a neuroscientist, still is. And said there's the arrow of-- she was talking to me, so she said, me to you and kind of what you perceive coming from me. And then there's you to me, and then there's an arrow from the middle going right back at each one of us, which is our own perception of what

02:45:51 the other person is thinking about us, and it's feeding back on the other arrow. And she gave me this very clear but model of basically relationships. The relationship failed, but it was good while it lasted, I should say. But the four arrow model of relationships actually shows up in every type of one-on-one relationship, and is probably an under description of the total number of arrows. But is I think it's exactly what you're describing is that perception of self through the eyes of other whether or not we're empathic or not strongly shapes

02:46:21 the way that we access different context dependent rule sets about what we're going to say or not. And it's very dynamic, right? SAM HARRIS: Yeah. But the freedom that I think we want and people can sometimes experience this just haphazardly, but the center of the bull's eye from the meditative point of view is to get off that ride entirely and to-- so that losing the sense of self in this context of a social encounter is to give up your face, essentially. And what that entails is or what that gives

02:46:59 you is the free attention to actually just pay attention to the other person. And the other person is now no longer quite an object in the world for you, there's really just a kind of a totality of which that person is a part. And actually, Martin Buber, the mystical Jewish philosopher talked about the I-thou relationship. And I think it's been a long time since I've read Buber. But and I don't know if he goes far enough to be truly non-dualistic, but there's distinction between I and thou because the thou part of it is, I think,

02:47:41 potentially this. Again, it's been several decades since I read him. But there's a way of beholding another person where you have the free attention to simply behold them. You no longer care what they think about you. You don't feel neurotically implicated by their gaze. You don't feel-- you're simply the space in which they're appearing, and so you're free. So by definition, you're no longer self-conscious. And this phrase, self-consciousness, really does get at this, what I'm calling the self, the illusory self as a kind of contraction.

02:48:29 And you can notice this for yourself. Just imagine what it's like to go from not being self-conscious to suddenly being self-conscious. And the proximate cause of this almost invariably is suddenly recognizing that somebody is looking at you. It's like you're in a Starbucks and you're alone and you're reading the newspaper or whatever it is. And this now sounds highly anachronistic. It's been three years since I've held a physical newspaper in a Starbucks. But you're just minding your own business.

02:49:04 And you look up, and you're seeing a room full of strangers. But then you notice that someone is just looking at you. And so that moment of eye contact, suddenly that throws you back on yourself as a kind of suddenly, you're the object in the world for that other person. That recognition is the tightening there, the kind of contraction there is a further ramification of this feeling most of us have most of the time of being the center of experience. It's like we're all walking around with a fist.

02:49:50 And in moments of self-consciousness, the fist gets really tight. And that's the thing that gets fully relaxed when you discover this, what in various point's called the nature of mind or the non-dual nature of consciousness. It's just that there is no center to this experience. And when you recognize no center, then even when your gaze is aimed at another person's gaze, there is no implication going back to the center because there is no center. And rather than that being an experience of weird detachment

02:50:25 or confusion, it's actually an experience of greater relationship because you're no longer defending it. You're not defending anything over here. You're not braced against anything, you're just the space in which that person is showing up. And so it's an experience of being much more comfortable in the presence of another person, whatever your relationship, because you're not contracting. Again, and this is meditation. This is meditation that is totally compatible with having a conversation with somebody.

02:51:02 And then when you notice your self contracting, when you notice you're not meditating anymore, you're actually reacting. Like, they just said something or looked a certain way and now, you're cast back upon yourself in relationship to them, that becomes a kind of mindfulness alarm. Then it becomes the unsatisfactoriness of that. Psychologically becomes more and more salient. Because one, that's not the way you want to be. I mean, it's like, it's the antithesis of it being as comfortable as you were a moment ago.

02:51:41 But two, it's something you're doing unnecessarily. it's like, again, you're making a fist when you don't have to make a fist. Again, you can leave aside all those circumstances where

it's appropriate to react to someone. And I'm into martial arts and self defense. And yes, you're not supposed to be just this puddle of goo out in the world who can be just mistreated by people and never put up resistance. But it's psychologically even if a state like anger or contraction is sometimes normative and appropriate,

02:52:21 the question is, how long is it normative and appropriate for? How long do you want to stay angry for? In my experience, these kind of classically negative emotions like anger and fear are appropriate as salience cues. They orient you to an emergency or a potential emergency. But then in dealing with the emergency, they're almost never the state you want to be in. Like, it's better to actually be calm in an emergency in a way. ANDREW HUBERMAN: Oh, absolutely. And again, the language is insufficient to describe

02:53:01 what you're telling us. But I think what comes to mind for me is this distinction between situational awareness and self-awareness. And we need both but under conditions of emergency, true emergency, or motivated desire. We need to dial down the amount of self-awareness in order to be more effective within the situational awareness. But you said something very important. And my lab has been working on fear-like states for a long time, so I confess I'm going to rob this from you, but I'll credit you every time I describe it,

02:53:38 is that the fear of the threat detection state or set of events acts as a flag but is not meant to persist in the way that the flag went up if one is to be in their most adaptive state. Actually, Jocko Willink and I were talking about this. He talks a lot about detachment and open gaze, things that my lab is interested in visual system and autonomic interactions. So why broadening the gaze literally broadens the time domain of thinking and you come up with new solutions to complex problems in real time and so on.

02:54:13 And you're describing an everyday set of interactions where that could be very useful. And yet, there seems to be something that about the way you describe meditation and what you've managed to arrive at and what practitioners of meditation can arrive at, which is something more than that. It's not just about being effective or optimizing, all the language we see thrown around a lot in the space that I live in these days, but something fundamentally more important about how to experience life and the self.

02:54:47 This realization that what you thought was there was never really there, but that there are constraints that limit that. And so to try and fracture those constraints one by one. Would you say that meditation as a practice done for a few minutes each day or with the app, that it's kind of a step function? Is it very non-linear in terms of people's progress? I'm certainly going to go start doing more meditation based on this discussion, truly. Because any time someone describes that there's kind of a myth that we've been living in,

02:55:24 I become obsessed with the idea of dissolving that myth. That's a very seductive phrase, so thank you for using that one. There is no better marketing tool, which is I realize what you're not trying to do here. But that's for me to capture my efforts. You tell me that there's a myth that I'm living in and that it can be dissolved, and that opens up a better landscape. What is the process like? Do some people make progress very quickly? Do some people experience kind of step functions towards progress?

02:55:54 What does the meditation practice look like over time? Do you still meditate or have you just threaded it through your jujitsu, your writing, your daily life, your coffee, your time with your wife, et cetera? SAM HARRIS: Yeah, also just to come back to talk about the myth for a second. So what you just enunciated was a kind of a second doorway into this whole project. So like, the usual door is through the door of suffering, for lack of a better word. When people feel unhappy in a variety of ways and they

02:56:27 get more sensitized to the mechanics of their own unhappiness. And meditation is one of the things on the menu that is explicitly built as a remedy for unhappiness. And it is. And that's I think that's probably the most common path to this. But another path is just intellectual interest. I mean, just wanting to know what's real about the mind subjectively in a first person way. And there's no contradiction between those two things, and I'm motivated by both of them. But it's a totally valid doorway into this.

02:57:02 There are definitely step functions. I mean, I would say there are at least two, and they really are articulated along the lines of the framework I've been describing of dualistic and non-dualistic mindfulness. So in the beginning, you're going to start out-- 99.9% of people will start out dualistically paying attention and noticing the difference between being distracted by thought and then being on the object of attention, whether it's the breath or sounds or whatever. And eventually, that opens up to all possible objects

02:57:39 of attention, including thoughts. And there's still this fluctuation between being distracted and then being mindful of whatever. And the fact that it's open to all possible objects differentiates this type of practice from anything that is narrowly focused on one object like a mantra or a visualization as I was just saying. Those are other paths of practice that are more concentration-based and interesting. But the benefit of mindfulness is that very quickly, you realize it's by definition compatible with all possible

02:58:12 experience, because you're not artificially contracting your attention down to something, you're just being aware of the next thing. A sight, a sound, a taste, a thought. So the first

step function is to very clearly experience the difference between being lost in thought and being clearly aware of any part of experience, including thought. And to notice the freedom, the comparative psychological freedom that gives. So something's made you angry and now you're thinking about all the reasons why

02:58:47 you should be angry and have every right to be angry and what you're going to tell that person when you see them, and then you notice you're thinking. And you notice the connection between the thought and the anger. Like, the minute spent lost in thought about what's making you angry is the thing that dragged through the physiology of anger. And the moment you notice that once you're mindful, once you can be mindful, you can notice thought as thought and how quickly that dissipates. That's just the language and the imagery.

02:59:20 You couldn't hold on to it if you wanted to. And then you notice the physiology of the anger is just this kind of meaningless, kind of inner incandescence that has its own half life and degrades very, very quickly when you're no longer thinking about the reasons why you should be angry. You can't hold on to the anger, the anger itself dissipates. And from the point of view of the one who's being mindful, this is tremendous relief. And at minimum, it's a degree of freedom. You can at that point decide, well, how long

02:59:52 do I want to be angry for? Is it useful to stay angry? Do I want to be angry for one minute, two minutes, five minutes, 10 minutes? And before you have that capacity to be mindful, you're going to helplessly be as angry as you're going to be for as long as you're going to be that way just based on the time course of your thinking about it, brooding about it, telling your wife about it. It's just going to be this conversation-based misadventure in negative states of mind, and you are going to be the hostage of that for as long

03:00:26 as you'll be the hostage of that. You have nothing you can do apart from just deciding to check out and watch Game of Thrones again for the third time. You can divert your attention to something else, which is sometimes a good thing to do. But mindfulness, even dualistic mindfulness gives you this capacity to just observe the mechanics of this and then get off the ride whenever you want. So that really is a step function. First, there was a time before you could do that, and then there's a time after which you can do that.

03:01:00 The other step function is noticing that there is no one who is doing that. I mean, this is the non-duality, the selflessness, the centralessness of awareness. The fact that there's no place from which the mindfulness is being aimed but the fact that there's just this open condition in which everything is appearing, thoughts included. To have you at that point, your mindfulness no longer becomes-- it's no longer this dualistic effort to strategically pay attention to anything as opposed to being lost in thought,

03:01:40 it's just what's left when the present recognized thought unravels. Even before it unravels, what's recognized is you are simply identical to the condition in which everything is appearing. Now, again, I'm not making a Deepak Chopra-like metaphysical claim about the mind. I'm not saying the mind isn't what the brain is doing, and I'm not saying that you're recognizing the consciousness that gave birth to the universe. I'm not making any broad claims about metaphysics, I'm just talking about as a matter of experience.

03:02:19 There is just this condition in which everything is appearing. And what you're calling your body, again, as a matter of experience-- I'm not saying that we can't have third person conversations about physical bodies in the physical world. But as a matter of experience, the only body you're ever going to directly encounter as your own is in appearance and consciousness. So consciousness is not in your body, what you're calling your body is in consciousness. Visually, proprioceptively, it's like everything is just

03:02:51 appearing in this condition. And again, this is not a spotlight that you're aiming at the body, there's just this condition in which everything, including anything you could call yourself is appearing. And so yeah, the second step function is to recognize that this is already true. Consciousness is already without this thing you've been calling your ego and hoping to unravel it through meditation. Consciousness is not going to get any more selfless, any more centerless, any freer than it always already

03:03:32 is recognized as such. And so the step function at that point is your mindfulness at that point, the thing you come back to when you're no longer distracted is that recognition again and again. And then it becomes compatible with anything you would do. And so to answer your question, yes, I still practice formally, sometimes, frequently. But I definitely miss days and I don't do it for-- I mean, I don't rule out the possibility that I will go back on retreat at various times just to check in with that and see if that makes a difference.

03:04:10 But I tend to sit for-- I mean, I've designed my life so that I can spend a lot of time meditating without having to be formally meditating. Like, so, I'll go for a hike for two hours. And what I'm doing when I'm hiking is identical to what I'm doing when I'm quote, "meditating", sitting in a chair, doing nothing but meditate. So yeah, I'm very interested in erasing the boundary between what people are calling meditation and the rest of life. And so in teaching these things, I tend to emphasize that from the beginning

03:04:55 because I think it's very easy to set up-- to get gold by a bunch of assumptions that cause you to be very split in your sense of what your life is about. And I'm sort of banking my

meditation over here because I'm meditating two hours a day diligently, and it's going to be really good for me. And then over here, this is the rest of my life, which is not nearly as wise or as useful or as like, this is the stuff that is still the area of my problems. And I think it's useful to recognize you've got one life,

03:05:39 and you've got this single condition of consciousness, and its contents in every mode of life. And there's something to recognize about it. And you're always free to recognize that. And truly even in your dreams. I mean, it never stops. So that's what I tend to emphasize. ANDREW HUBERMAN: So earlier, you told us that meditation is not about changing the content of conscious experience. And in a different podcast that you were on, I heard you say something to the effect of that normally we are in our daily experience and unless we are trained

03:06:14 in meditation, unless we've dissolved this illusion of the gap between actor and self and observer, that we require certain sensory events to create collisions within us and with the natural world that sort of blast us into a different mode of being. I want to use that as a way to frame up this idea that some things such as psychedelics but also a very long hike, a very long fast, who knows? A banquet, different types of life experiences do exactly the opposite of what you're describing meditation

03:06:58 does, which is that they actively change the content of our conscious experience so much so that we often remember those for the rest of our lives. Could you tell us why psychedelics can be useful? And here, I'll give the caveats that maybe you'll feel obligated to give as well, but we're talking about safely and responsibly, age-appropriate, context-appropriate, ideally with some clinical or other type of guidance, legality issues, obeyed, et cetera. All that stated, it was psychedelics to me are an experience of altered perception,

03:07:37 internal and external perception, altered space time relationship, somewhat dreamlike. I think it was Alan Hobson at Harvard for a long time talked about the relationship between psychedelic-like states and dream-like states because of this distortion of space time dimensionality. And I haven't experimented with them much. I've been part of a clinical trial, three doses of MDMA, which certainly altered the quality of my conscious experience in ways that led to a lot of lasting and at least for me,

03:08:08 valuable learning. So what are your thoughts about psychedelics in terms of how they intersect with the discussion that we've been having? And what utility do they play in recognition of the self or in other sorts of brain changes? SAM HARRIS: Well so, let's just price in all those caveats that people can anticipate. These drugs are not without their risks. And one problem is that we have this single-term drugs or psychedelics, which names many different types of substances, and they're not all the same.

03:08:43 So like, MDMA is not even technically a psychedelic. I think it has immense therapeutic value, and it actually was my gateway drug to this whole area of concern. ANDREW HUBERMAN: Amphetamine pathogen, right? It's a sort of an amphetamine and a pathogen at the same time. SAM HARRIS: Yeah, I mean it's, often called-- ANDREW HUBERMAN: M pathogens. SAM HARRIS: Yeah, and a pathogen-- ANDREW HUBERMAN: Not a pathogen, M pathogen. SAM HARRIS: And a pathogen or an entactogen, it's been called. But it doesn't tend to change perception in the way

03:09:13 that classic psychedelics do. And it's also serotonergic, but it has to be in some part differently. And even LSD and psilocybin, which are much more similar and classic psychedelics, both are also serotonergic but they're not merely, and they're also different. And the higher dose you take of these drugs, the more-- at lower doses everything, can kind of seem the same. At higher doses, they begin to diverge. And we can talk about the pharmacology if you wanted to. But I would just say that for many of us,

03:09:54 and certainly for me, psychedelics were indispensable in the beginning in proving to me that this was-- the first person interrogation of the mind was worth doing. Because I was somebody who at age 17 or 18, before I had any real experience with MDMA or LSD or psilocybin, if you had taught me how to meditate at that point, I think I would have just bounced off the whole project. I think I was so cerebral in just my engagement with anything. I was so skeptical of any of the religious and spiritual

03:10:45 traditions that have given us most of our meditation talk that I think I just would have-- And I know many of these people. I have tried to teach Richard Dawkins to meditate and Daniel Dennett to meditate. I've ambushed them with meditation both in a group setting and one-on-one. Not Dan but Richard, I ambushed on my own podcast with a guided meditation. And he closes his eyes, he looks inside, and there's nothing of interest to see. He doesn't have the conceptual interest in him that would cause him to persist long enough to find out

03:11:35 that there's a there there. Now, this is not a problem with LSD or psilocybin or MDMA. I know that if I gave him 100 micrograms of LSD or 5 grams of mushrooms or 25 milligrams of psilocybin-- that's probably not the analogous dosage to the 5 grams of mushrooms. 5 grams of mushrooms would be more than that. I forget what it is of MDMA, maybe 120 milligrams. ANDREW HUBERMAN: I think the maps dose, which is the one that's under clinical trials is 125 milligrams with an option of a 75 milligram booster.

03:12:14 Funny, I remember it. SAM HARRIS: Yeah, that's strange, the facts that come to hand. But there's just no possibility that nothing's going to happen right now. Something with a psychedelic, with MDMA, most people tend to have certainly under any kind of guidance, tend to have a very positive, pro-social experience. But with a psychedelic, you might have a somewhat terrifying experience if you have quote, a bad trip. And I've certainly had those experiences on LSD and to some degree, on psilocybin.

03:12:55 But the prospect that nothing is going to happen is just in nearly a million cases out of a million just not in the cards. I mean, just neurophysiologically, something is going to happen with the requisite dose of one of these drugs. And if that thing that happens is psychologically at all normative and pleasant and interesting and valuable, which it is so much of the time and certainly under the appropriate set and setting and guidance, it can be a lot of the time for virtually everybody. Again, there are caveats.

03:13:39 If you're prone, if you think you have a proclivity for schizophrenia or bipolar disorder, this is almost certainly not for you. And anyone doing the studies at Johns Hopkins for the therapeutic effects of any of these drugs, they're there ruling out people with-- first degree relatives with any of these clinical conditions. So for somebody like me at 18 who didn't know that this was an area of not only interest but would it be the center of gravity for the rest of his life, if only he could pay attention

03:14:21 clearly enough to see that it could be, I was someone who very likely-- again, I don't have the counterfactual in hand. I don't know what would have happened if someone had forced me to meditate for an hour at that point. But I know I wasn't interested in it until I took MDMA. I know I wasn't having these kinds of experiences spontaneously that showed me that there was an inner landscape that was worth exploring. I was a very hard-headed skeptic who was very interested in lots of things, but there was no alternative to me just thinking

03:15:00 more about those things. I mean, the idea that there's some other way of grasping cognitively at the interesting parts of the world beyond thinking about the world, that just wouldn't have computed for me at all. No one ever gave me a book to read or I never had-- The noun, meditation, very likely meant absolutely nothing to me before I took my first dose of, in this case it was MDMA. So what the drug experience did for me is it just proved-- So one of the limitations of drug is that, obviously, no matter how good the experience,

03:15:48 the drug wears off and then you're back to in more or less your usual form, and now you have a memory of the experience. And it can be a fairly dim memory. I mean, some of these experiences are so discontinuous with normal waking consciousness that it can be like trying to remember a dream that just degrades over the course of seconds. And then it could have been the

most intense dream you've ever had and for whatever reason, you can barely get a purchase on what it was about. And there are some psychedelic experiences

03:16:21 that are analogous to that. But for most people most of the time, there's a residue of this experience. And with something like MDMA, they can be quite vivid. Where you recognize there was a way of being that is quite different than what I'm tending to access by default, and it is different in ways that are just obviously better and psychologically more healthy. I mean, it's possible to be healthy psychologically in a way that I never imagined. And then when you link it up to the traditional literature

03:17:07 around any of this stuff, again, so much of it is shot through with superstition and other worldliness of religion. And as you know and I think you're listeners probably know, I've spent a lot of time criticizing all that. But there is a baby in the bathwater to all of that. It's not that somebody like Jesus or the Buddha or any of the matriarchs and patriarchs of the world's religions, it's not that they were all conscious frauds or temporal lobe epileptics, there's a pathological lens that you can put on top of all that.

03:17:46 But once you have one of these experiences on psychedelics or on a drug like MDMA, you know that there's a there there. You know that unconditional love is a possibility. You know that feeling truly one with nature. I mean, just so one with nature that you could spend 10 hours in front of a tree and find that to be the most rewarding experience of your life. That's a possible state of consciousness. Now, it may not be the state of consciousness you want all the time. You don't want to be the crazy guy

03:18:20 by the tree you know who can't have a conversation about anything else. But once you have one of these experiences, you recognize, OK, there's some reason why I'm not having the beatific vision right now. And I can't even figure out how to aim my attention so as to have anything like it. And that's a problem, because it's available, and it is among the best things that has ever happened to me. And now I can just only dimly remember what that was like. So how do I get back there on some level? So that invites, again, a logic of changes.

03:19:02 A logic of seeking changes in the contents of consciousness, which sets someone up for this protracted or seemingly protracted and fairly frustrating search to game their nervous system so as to have those kinds of experiences more and more. And again, it's not that that's in principle fruitless but it is from the point of view of the core insight, the core wisdom of what I would take from a tradition like Buddhism, which is not the only tradition that has given voice to this, but I would argue it's given it voice to it

03:19:42 in the most articulate way. Again, leaving aside any of the superstition and other worldliness and miracles that we don't have to talk about at the moment. And you certainly don't need to endorse in order to be interested in this stuff. And so that's the bifurcation between all of the utility of psychedelics and what I'm talking about under the rubric of meditation is at this point of OK, once you realize there's a there there, what do you do? And what's the logic by which you're led to do it?

03:20:20 And it's possible if you're only framework is the good experiences, the good feels you had on whatever drug it was and a further discussion of what that path of changes can look like-- and that can become in a religious context, it can come in just a purely psychedelic context or some combination of the two. I think you can be misled to just seek lots of peak experiences. You're just trying to string together a lot of peak experiences hoping they're going to change you, every one of which, by definition is

03:21:03 going to be impermanent. It's first it wasn't there, then it's there, and then it's no longer there. And then you've got a memory of it. What I think what everyone really wants whether they know it or not, and they're right to want, is a type of freedom that is compatible with even ordinary states of consciousness, which can ride along with them into extraordinary states of consciousness. So I hadn't done psychedelics for 25 years because, again, they were super useful for me in the beginning, then I discovered meditation on the basis of those experiences,

03:21:41 got really into meditation and realized, OK, this is a much more-- conceptually, this makes much more sense to me. This is delivering the goods in terms of my experience. There's no need to keep having these-- seeking these peak experiences with drugs. But it had been 25 years since I had done that and there was this resurgence in research on psychedelics. And I was being asked about psychedelics, and I was talking about their utility for me, but again, these were distant memories. And there was also one type of psychedelic experience

03:22:17 I was aware that I had never had. I had never done a high dose of mushrooms blindfolded. Every mushroom trip I'd ever had I'd been out in nature and interacting with-- it's just been a very transformed sensory experience of the world and of other people. But I'd never done it alone, blindfolded, just purely inwardly directed, and at a high dosage. I'd done high doses of LSD but not mushrooms. So I did that and it was very useful. And I spoke about it on my podcast, and there's actually-- I think if you search "Sam Harris mushroom

03:22:55 trip" on YouTube, you get the 19 minute version of my describing that trip. It was incredibly useful, but what was doubly useful was my mindfulness training in the context of that explosion of synesthesia. I mean, it was such an overwhelmingly strong experience, and there were so many moments where it could have gone one way or the other based on my sense of just, OK,

I'm going to try to resist this. It was in truth irresistible because it was just so much, but there were moments where I was aware of, OK, this is--

03:23:40 letting go of self in this context is the thing that is going to make the difference between heaven and hell here because there are experiences that are so extreme that you can't even tell if it's agony or ecstasy. Everything is turned up to 11. And the difference between the two is-- the tipping point is just-- really it's a high wire act in some sense. You could just fall to one side or the other. Yeah, so what I think people want is-- they certainly want to be able to extract from the psychedelic experience, wisdom

03:24:26 that is applicable to ordinary states of consciousness. It's like, what is the thing you can realize in a moment of having a conversation with your child that isn't distracting you from that relationship? It's not a memory of when the world dissolved or when you were indistinguishable from the sky, but it's just a way of having free attention and unconditional love in this totally ordinary and potentially chaotic human experience, which can be psychologically fraught and you can meet iterations of yourself that you

03:25:05 don't like that are not equipping you to be the best possible person in that relationship. And what we want to do is cut through all of that and actually be in love with our lives and with the people in our lives more and more of the time. And I'm not saying that repeated psychedelic journeys can't be integral to that project, but you know that the project can't be being high all the time. So whatever is extractable from the occasional psychedelic trip has got to be manageable into ordinary waking consciousness.

03:25:48 And the real point of contact does run through this-- what I've been calling the illusion of the self. And again, that part is discoverable without any changes in contents. So you don't have to suddenly feel the energy of your body rush out and be continuous with the ocean of energy that is not your body. That's an experience that's there to be had, I mean, there's no doubt. But the truth is just looking at this cup is just as formless and as mysterious as that when seen in the right way, and that's

03:26:32 what meditation encourages one to recognize. ANDREW HUBERMAN: I share the experience that MDMA significantly altered my perception of what's possible in terms of an emotional stance towards self and others, including animals, something that runs very deep for me and that I had been actively suppressing in anticipation of having me put my dog down. But also, I don't know how to frame it except to say, my lab did animal research for years, and I was always very conflicted about it because I love animals

03:27:05 and yet I wanted to understand the brain and we need to work on animal brains, and we-- SAM HARRIS: Rodents or what? ANDREW HUBERMAN: Yeah, I'll be very direct about this. I've worked on many species. I've worked on mice and rats. Admittedly, I've worked on-- I've done some cat experiments. I've worked on large, non-human primates including macaques. I no longer work on any of those species. I've worked on cuttlefish, cephalopods, a discussion for another time, brilliant little creatures, maybe

03:27:39 as smart as us, or who knows? Maybe smarter. And now I work on humans because I couldn't reconcile the challenge inside me, which was my love of animals and working on them. I just couldn't do it any longer. And MDMA didn't set that transition, that transition actually had been set a lot earlier. It's something I really grappled with. It didn't keep me up at night, but it was always in the back of my mind. In any event, I hope what we discovered was worthwhile, but this that's a bigger debate. And I've strong feelings about this,

03:28:12 and maybe it's a topic for another podcast. But I'm very happy that now I work on humans, and they can tell me if they want to be part of the experiment or not, and I trust them and I trust their answers. I think that MDMA, in its role as an pathogen, I think really did set an understanding of what's real and true. So I think truths like that become-- I felt that they didn't hit me square in the face. The feeling behind the conflict made itself evident, and what to do about it made itself evident.

03:28:46 So I suppose MDMA did assist the transition to purely human research, as opposed to animal research. The other thing that I noticed it did is it made it not scary to confront things that were scary to confront in my conscious life. And I could think about things in my conscious life, but it brought them close in a way that I could get closer and closer to the flame and then gain some understanding. I'm still amazed at how answers arrive, both during the session and in the weeks and months that follow if one

03:29:19 puts the attention to it. I think that's why it's important to have a guide of some sort or to have some pseudo structure because otherwise one can get attached to the sounds in the room. And there's probably meaning there, but I wanted to do some deeper work. I have not had experience with psilocybin, at least not since my youth. And I don't recommend young people do it. I regret doing LSD and psilocybin as a young person. I don't say that for politically correct reasons or liability reasons, I just think my mind was not developed.

03:29:47 But I'm intrigued by something-- so here's the question-- how is it that psilocybin in particular and high dose psilocybin and the ego dissolution that people talk about on psilocybin-- how do you think that lines up with some of the experiences that you've been describing for a adequate meditation practice? Because that's something that I did not experience on MDMA. In

fact, if anything, I experienced for the first time what really feeling like a isolated container was, and the difference-- and how empathy and being bounded--

03:30:21 having, in other words, good boundaries and empathy could be symbiotic. I experienced that for the first time there. And I do think that there is learning inside of these states that translates into everyday life when one is not on these states. And the last thing I'll say is, no, I don't feel the impulse to go and do 20 more MDMA sessions. I think the three as part of this study were very effective for me. As I say, if you hear the calling again you might do it, but I'm very curious about psilocybin in particular

03:30:51 and this notion of ego dissolution because we've been talking about the self. SAM HARRIS: Well, so there are different ways in which the sense of self can be eroded or expanded. There's lots of experiences that can still have a center to them but be very novel and transformational. And one can reify those as a goal state. There's a concept in Buddhism that I think is useful. It doesn't translate well to English, or it can set up false associations in English that are unfortunate. But so there's a concept of emptiness in Buddhism, which

03:31:37 sounds, again, gray and dispiriting in English, but its cognate terms are things like unconditioned, unconstrained, open, centralist. When I'm talking about non duality, when I'm talking about the loss of a sense of subject and then what's left, in Buddhism, they would often describe what's left as emptiness. But an emptiness is not a something. Importantly, it's not the same thing as unity, so it's not a oneness because it's-- When the center drops out of experience, it's not like you are suddenly merged with the cup.

03:32:35 Now, granted, this is where psilocybin and other psychedelics can give a false impression of I think what the goal is. You can have seeming merging experiences-- you can have unity experiences on psychedelics, which can be quite powerful, especially with other people and with nature, where you can just feel the energy of your body becomes incredibly vivid and powerful. It's like everything is just buzzing with life energy. And then when you touch another person's hand or you touch a tree, there can be

03:33:18 this continuity of energy, which can be this overwhelming experience. And again, this is a 20 megaton change in the contents of consciousness. This is a non ordinary state of consciousness. To give some indication of how this happens-- back in the day when I was in my 20s and I was experimenting with-- this was LSD, but some friends and I had decided-- we had this brilliant idea. We would camp above Muir Woods and then take some LSD at dawn and then walk down like a mile I think from the campsite

03:33:58 into the actual proper grove of trees and commune with the giant redwoods, the tallest trees on Earth. And so we dropped the acid at dawn, and we start walking, but the acid came on almost immediately. And we didn't get-- I mean, we got nowhere near the woods, and we got stopped by a tree that was just like an ordinary 20 foot oak tree, the most boring tree in the world. And that tree absorbed the next six hours of our conscious attention because it was just-- it was the tree of life. I mean, there could be no better tree.

03:34:30 So we're talking about nonordinary states of consciousness wherein a merging with life and with the world is possible. So I'm not saying that kind of experience isn't possible, but there's a sort of expanded self reification. It is a kind of ego dissolution, but there's a kind of egoity that goes along for the ride as well, or can go along for the ride. And the real insight into emptiness, the real centerless center of the bull's eye is a recognition that in some ways equalizes all experiences.

03:35:15 And again, it's just as available now in this ordinary podcasting experience as it is when you're merging hands on with an oak tree, and on 400 micrograms of acid, and this is the whole universe. And so it's the equality of those two experiences that this concept of emptiness captures, which a concept of oneness doesn't quite capture because oneness is really this peak experience of being dragged out of your somethingness into a much bigger somethingness. Emptiness is just no center and then everything is in its own place.

03:36:01 There's still sights, and sounds, and sensations, and thoughts, and feelings, but there's no there's no center and there's no clinging to anything. There's no clinging to identity, there's no clinging to the good stuff, there's no there's no resistance to the bad stuff. So pleasant and unpleasant get strangely equalized, and it's very expansive. And most importantly, it doesn't block anything. So yeah, if for whatever reason if your nervous system is set up to have the, oh my god, I'm now merging with the tree experience, that's

03:36:39 possible from the state of no center. And on my recent-- now not so recent, three years ago, it was right before COVID, but my last big psychedelic experience, I was very much experiencing that. Whereas, insofar as I-- at the peak, there was no me to remember any of this stuff. But insofar as I could experiment with-- is this really different from anything else? There is a equalizing to the emptiness recognition, even in the presence of a completely transformed neurophysiology. Again, there's a point of contact.

03:37:26 I mean, the real point of contact between psychedelics and meditation for me is-- but for my experiences on psychedelics, I think there's just no way I would have had the free attention to be interested in the project at all. And there are other aspects to the project. It's not just having this insight into selflessness, it's all of the ethical ramifications of that. It's just like, what

kind of person do you want to be? What are your values? What is a good life, altogether, when you are talking about relationships,

03:38:00 and political engagement, and the changes you can make in the world or not make? It's just, what kind of person do you want to be? There's a much larger consideration. And I mean, as you discovered, an experience on MDMA can really both expand your model of what is possible, and what is desirable, what is normative. I mean, just what kind of self do you want to be in the world? And it can also help you cut through things that are inhibiting your actualizing any of those possibilities in ordinary waking consciousness.

03:38:40 ANDREW HUBERMAN: I've certainly found that to be the case. I mean, you raise a really important point, which is that once these learnings take place, these understandings take place inside of psychedelic journeys-- I do believe they translate to neuroplasticity. I do want to highlight the point for people. Oftentimes people say, oh, you know, this mushroom or this psychedelic it opens plasticity, but of course, plasticity has to be directed someplace. Plasticity is just a process like walking or anything

03:39:12 else, underlying neural process. And I think it's impossible for me to understand what compartments of my life have been impacted by these three MDMA sessions. But in some ways, I wonder whether or not, not just the transition away from animal research, but also a deeper realization of the love for learning and sharing information. I won't go so far as to say this podcast is happening because of that particular session, but these things they splay out into multiple domains of the self. And I do think that the key features that

03:39:47 feel most important to me to mention are that it really identified true loves, things that I truly love, and made me less cautious about feeling how intense those loves really are. And then also lowered the inhibition point of exploring, well, what would that mean? And one of the reasons I bring this up, and why I think it's so important that you mentioned some issues around politics and ethics and that many things have splayed out from your exploration of psychedelics, meditation, neuroscience, philosophy, all the things that are you,

03:40:23 and of course, that's only a subset, is that so much of what I hear and see, so much of what I hear and see in the self-help space, contradicts itself and leads back to the origin without a lot of progress. For instance, we hear absence makes the heart grow fonder but then out of sight, out of mind. You hear about radical acceptance, but then what if it's radical acceptance of non acceptance? I mean, there are some experiences in people for which I radically accept the fact that I want nothing to do with them.

03:40:59 Am I supposed to transcend that? So these are the questions I think that keep a lot of people from exploring things like meditation because they feel like, well, is the idea to just be OK with everything? Is radical acceptance just like-- we'll just bulldoze me with things even if they-- and my goal is to somehow surpass the idea that they're harmful. And I don't think that's actually the way any of this stuff is supposed to work, although I don't claim to be the authority on it either. I think notions of radical acceptance,

03:41:31 and radical honesty, and any number of different sayings that one can find out there are really the most salient beacons and guides that most people have in order to try and navigate tough areas in their life, including the relationship to self, but others and political orientations. And so I feel like almost all those things can be used to anchor down in a stance that may or may not be informed or to open up to ideas. And so I think that none of this can really be solved in a single practice it sounds like,

03:42:02 but it does seem to me, based on what you've told us today, is that only through a deep understanding of the self as it really is, as opposed to this illusion that you framed up, could we actually arrive at some answers about what's actually right for each and every one of us. SAM HARRIS: Yeah, I mean, there's one generic answer that I think can be extracted both from psychedelics and from meditation and from just thinking more clearly about the nature of our lives. And it's to become more process oriented,

03:42:39 and to be more and more sensitive to the mirage like character of achieving our goals. Now, I'm not against achieving goals. I have a lot of goals. I'm very busy. There are lots of things I want to get done, and I'm satisfied as anyone to finish a project. But if you look at the time course of all of that fulfillment and-- there are a few lessons everyone I think has to draw. One is, most of your life is spent in the process. The moment at which the goal is fully conquered, that is just-- I mean, that has a tiny duration,

03:43:24 and it has a very short half life. The moment you arrive at it, it begins to recede because, in the meantime, you have all these other goals that have appeared on the horizon. You've got people asking what you're going to do next, and in some sense, if you're focused on goals, you can never arrive. And I think what we're all looking for in life, whether we're ever thinking about taking psychedelics or practicing something like meditation, we're looking for good enough reasons to let our attention fully rest in the present.

03:44:14 That is the logic of success. The sense like, I've got all these things I want to do-- if I could just get rich enough, or fit enough, or dial in my sleep well enough, or improve my life in all of these ways, get the right relationship, wouldn't it be great to be married, I want to start a family, I want all of these things. Why do I want these things? I want these things because I'm telling myself--

all of those things are wonderful, I'm not I'm not discounting those relative forms of happiness or sources of happiness

03:44:46 because it's all completely valid, it's completely valid to want those things. But one thing is absolutely clear, it's possible to be miserable in the presence of all of those things. And you can add great wealth, and fame, and everything on top of that, and It's possible to be absolutely miserable having everything anyone could seemingly want. You just have to open a newspaper just to see people living out that predicament-- spectacularly wealthy, famous, healthy, successful people who could do anything they want in life, apparently,

03:45:20 and yet they're doing this thing that is completely dysfunctional and making them needlessly miserable. I won't name names, ANDREW HUBERMAN: There's enough of them out there. SAM HARRIS: Some people come to mind at the moment. So there is a clear dissociation between having everything and happiness that's possible. And it's also possible to have very little, and almost nothing, and to be quite happy. I mean, you might not have met these people, but I have met people who have spent 10 years alone in a cave.

03:45:55 And they come out of that cave not floridly neurotic or psychotic, they come out of that cave beaming with compassion and joy. And I mean, they've been taking MDMA for 10 years, essentially, and they come out of the cave and now they're going to talk about it. And I'm not necessarily recommending that project to anyone. I'm just saying, that is a psychological possibility. So you have a double dissociation here, whether you can have everything and be miserable, or you can have nothing and be beaming with happiness.

03:46:24 So what is it that we actually want in all of our seeking to arrange the props in our lives and to have a convincing enough story to tell about ourselves that we're doing the right thing? What is all of that effort predicated on? It's predicated on this desire and this expectation that if we could get all of this stuff in the right place and not have anything terrifying to worry about, everyone we love is healthy for the moment, and we're healthy, and we've got something to look forward to on the weekend,

03:47:00 and there's not a plumbing leak in the house that we have to immediately respond to, and we like our house, and our career is going fine, and there's something good to watch on Netflix, and we have all of it, now can we just actually give up the war? Can we fully locate our sense of wellbeing in the present moment? Can we relax the impulse to brood about the past or think anxiously about the future for long enough to discover that all of this here is enough? Because our life our life is-- we have this finite resource of--

03:47:44 I mean, we absolutely have the finite resource of time, but within this the finite continuum of time, we have the even more precious resource of free attention that can find our fulfillment in the present. Because even if we're even if we're guarding our time to do the things that are most important to us, we can spend all of that time regretting the past, or anxiously expecting the future, and just bouncing between past and future in our thinking about ourselves and our lives, and basically just dancing over the present

03:48:28 and never making contact with it. So I think what we want is a circumstance where a tension can be located in the present in a way that's truly fulfilling. And unless you have had some kind of radical insight that allows you to do that on demand, you are in some sense hostage to the circumstances of your life to do that for you. You're constantly trying to engineer a state of the world that will propagate back on a state of self that will make the present moment good enough. And what meditation does, and psychedelics to some degree

03:49:09 does this, but meditation very directly does this, it reverses the causality and lets you actually change state such that you can be fulfilled before anything happens. Your happiness is no longer predicated on the next good thing happening. You can be in the presence of the next good or bad thing already being fulfilled and already being at peace. I mean, there's a-- I think there are misleading nouns we can throw at what is left there, but it is tranquility, peace, freedom, lack of contraction,

03:49:50 lack of conflict. I mean, all of that can be more and more of a default. And all of that is also compatible with deciding, yeah, why not get in shape? Why not engage this project? Why not change your career? I mean, it's not it's not that you need to be somebody who-- I mean, to your point, you can notice all of these non optimal things because no matter how much you meditate, you're very likely going to spend a lot of your time still lost in thought, still identified with it, and still caring about the difference between dysfunction and normativity

03:50:30 in your life. The question is, what can you what can you locate when-- the question, it's like, how much can you puncture that seeking happiness project with the recognition that you're already free? That's what meditation makes possible. You can keep just 1,000 times a day letting some daylight into this search space. But it is still compatible. I mean, working out is a great frame in which to look at this because, I mean, in working out, when you really work out-- I'm thinking mostly of-- I mean, it's really anything, but it's

03:51:18 resistance training, or cardio, or something like jujitsu. You're intentionally putting yourself in classically unpleasant circumstances, physiologically. I mean, imagine what it's like to do anything to failure. Well, if you just check in on what that is like at the level of sensation, I mean,

that is basically-- it feels like a medical emergency. If you were having that experience for some other reason, like if you woke up in the middle of the night and felt what it feels like to be deadlifting

03:51:52 on your 10th rep on a set where you would fail at 11, that's an emergency. But because you understand what you're doing in the gym, and you've sought out, and it's actually something you like doing, and you can get a real dopamine hit from doing it, what you're doing when you're doing that is you're owning a-- you're actually transforming a classically negative experience into something that's almost intrinsically positive, certainly the net on it is positive. Being able to do that is more and more

03:52:43 the experience of being actually at peace, even while exerting really intense effort in one direction. So you can be straining, and I'm sure physiologically showing a lot of stress, I mean, I'm sure the cortisol is up, and blood pressure's up, heart rate is certainly up. So it's like, as far as the body is concerned, it's stress as far as the eye can see. But you really can be deeply equanimous and at peace, again, because of the frame around it, because of the concepts attached to it, because you know what you're doing,

03:53:20 you know why it's happening, and you want it. So that's an attitude you can bring into other stressful things that take effort to accomplish. And so it's not that you just need to be a pushover when you learn how to meditate, or when you take MDMA, or work on yourself in any of these ways. But what I think you want to find is you want to find your point of rest in the midst of any struggle. ANDREW HUBERMAN: I would say that, certainly MDMA but, and again, I have less experience with meditation,

03:53:56 but they really I think put us, ultimately, in positions of what can only refer to as real strength. These can make what before seemed like impossible decisions, or even concepts or emotional states to even think about for any period of time without deliberately distracting or avoiding in some other way and be able to lean into those with open eyes. To me that's my definition of strength. I don't know what other people consider. But there's definitely something real there in each case. This may seem like a divergence but I and many other people

03:54:34 are very curious about a recent decision that you made, which was to close your account on Twitter. You still have an Instagram account I noticed. SAM HARRIS: I mean, my team manages that. I've never-- ANDREW HUBERMAN: It's a lot friendlier over at Instagram. I've been there a lot longer-- SAM HARRIS: I've never even seen it. ANDREW HUBERMAN: Oh, it's pretty good actually, considering-- imagine what would happen if you did pay attention. They're doing a good job with it. But your decision to close your account on Twitter I think

03:55:04 grabbed a lot of eyes and ears, and there's a lot of questions about why. It was a very large account. It correlated with a number of things that, for the outsider, people might be wondering about new leadership, people who had been booted off, brought back on, or at least invited back on, and so on. You are certainly not obligated to explain your behavior to me or anybody else for that matter. But I'm curious if you might share with us what the motivation was for taking the account down, and how you feel in the absence of--

03:55:44 I mean, your thumbs presumably are freed up to do other things. SAM HARRIS: Yeah, I was getting like an arthritic right thumb I think, and I think it-- ANDREW HUBERMAN: If you don't mind sharing, I think there's a lot of curiosity about you and your routines. You've been very generous in sharing your knowledge, but also what makes you tick, what motivates pretty big decisions like that? It was a major platform for you. SAM HARRIS: Right, yeah, so it was the only social media platform I've ever engaged.

03:56:15 I mean, like you said, I have an Instagram, I have a Facebook account, but I've never used those as platforms. I was never on them, I've never followed people. All the posting has just come from-- it's just marketing from my team. But Twitter was me, I mean, for better or worse, and I began to feel more and more for worse. And it was interesting because it was very-- I've talked about it a lot of my podcast, about my love/hate relationship with Twitter over the years. Many good things came to me from Twitter,

03:56:52 and I was following a lot of smart people. And it had become my newsfeed and my first point of contact with information each day. And I was really attached to it just for that reason, just as a consumer of content. And then it was also a place where I genuinely wanted to communicate with people and react to things. And I would see some article that I thought was great, and I would signal boost it to the people following me on Twitter. And that was rewarding, and I could literally help people on Twitter.

03:57:27 I mean, there are people who have raised lots of money for on Twitter just by signal boosting their GoFundMe's. And so I was engaged in a way that seemed productive. But I was always worried that it was producing needless conflict for me and was giving me a signal in my life that I was being lured into responding to and taking seriously that was out of proportion to its representation of any opinion or set of opinions that I should be taking seriously. So I was noticing that-- and again, this evolved over years,

03:58:09 I mean, this long predated recent changes to Twitter, but I was noticing that many of the worst things that had happened for me professionally were first born on Twitter. I mean, just like some conflict I got into with somebody, or something that I felt like I needed to podcast about in response to on Twitter. Just so much of it, either it's genesis was Twitter, or it's the further spin of it

that became truly unpleasant and dysfunctional happened on Twitter. It was just-- Twitter was part of the story when

03:58:50 it got really bad. And I've had vacations that have gone sideways just because I got on Twitter and said something, and then I had produced a controversy that I had to respond to, and then I had to do a podcast about that. And it was just, this is a mess. And so at that point, I have friends who also had big Twitter platforms who would say why are you responding to anything on Twitter? Just tweet and ghost. Joe Rogan-- ANDREW HUBERMAN: Yeah, post and ghost. SAM HARRIS: sat me down and tried to give me a talking

03:59:24 to, as did Bill Maher. And both of them engage Twitter in that way. I mean, I think they basically never look at their ad mentions. They never see what's coming back at them. They use it effectively, the way I use, or don't even, use Instagram or Facebook. I mean, I don't even see what's going out there in my name. And so I could essentially do that for myself on Twitter, presumably. And I did that for some periods of time, but then I would continually decide, OK, now it's all balanced again, maybe I

03:59:54 can just communicate here because it was very tempting for me to communicate with people because I would see somebody clearly misunderstanding something I had said on my podcast, and I think, why not clarify this misunderstanding? And my efforts to do that almost invariably produced a-- sometimes it was a meandering process of discovery. But often, it was just a stark confrontation with what appeared to me to be just lunacy and malevolence on a scale that I'd never encounter elsewhere in my life.

04:00:34 I'd never meet these people in life, and yet I was meeting these people by the tens of thousands on Twitter. And so the thing that began to worry me about it-- and again, I understand that people have the opposite experience. I mean, depending on what you're putting out and the kinds of topics you're touching, you could have just nothing but love coming back at you on Twitter. But because I am very-- essentially, in the center, politically, and because this is now on my podcast, this is not in the Waking Up app.

04:01:10 I'm often criticizing the far left and criticizing the far right. I'm basically pissing off everyone some of the time. It's different, if you're only criticizing the left, no doubt you get hate from the left, but you have all the people on the right who just reflexively and tribally are expressing their solidarity for you, and who are dunking on your enemies for you and when your enemies come out of the woodwork. And if you're only criticizing the right, you get a lot of pain from the right, but you've got the people on the left who are tribally

04:01:47 identified with the left, who are just going to reflexively defend you. If you're in the center criticizing the left as hard as anyone on the right ever criticizes the left, and you're also criticizing the right as hard as anyone on the left criticizes the right, you're getting hate from both sides all the time, and no one is reflexively and tribally defending you because you pissed them off last time. You might be getting hate from the left now, and the people on the right agree with you but they can't forget the thing you said about Trump

04:02:20 on that podcast two podcasts ago, so they're not going to defend you. And so I basically created hell for myself on Twitter because it was just a theater of-- it was just pure cacophony most of the time. And what I was seeing was-- I mean, there's no way there's this many psychopaths in the world, but I was seeing psychopaths everywhere. I was seeing the most malicious dishonesty, and just goalpost moving, and hypocrisy. I mean, some of it's trolling, and some of it's real confusion, and some of it is psychopathy,

04:03:00 but it's like, it was so dark that I worried that it was actually giving me a very negative and sticky view of humanity that was-- I mean, one, I think it is inaccurate, but two, it was something that I was returning to so much because, again, I was checking Twitter at least a dozen times a day, and I'm sure there were some days where I checked it 100 times a day. I mean, it was, again, it was my main source of information. I was constantly reading articles and then putting my own stuff out. That it became this kind of fun house

04:03:43 mirror in which I was looking at the most grotesque side of humanity and feeling implicated in ways that were important because it was reputationally important, or seem to be important. I know a lot of these people. These weren't just faceless trolls, these are people with whom I have had relationships and in some cases friendships, who because of what, largely, Trump and COVID did to our political landscape in the last half a dozen years, we're beginning to act in ways that seemed starkly dishonest and crazy making to me.

04:04:27 So I was just noticing that I was forming a view of people who I actually have had dinner with that was way more negative, based on their Twitter behavior, then I think would ever be justified by any way they would behave in life with me. I mean, I was never going to have a face-to-face encounter with any of these people that was this malicious, and dishonest, and gaslighting, and weird as what was happening hourly on Twitter. And so I just began to become more sensitive to what this was-- just the residue of all of this in my life,

04:05:08 and just how often the worst thing about me in my relationship with the people in my life, like just talking to my wife or my kids, was just the fact that I had been on Twitter at some point in the previous hour. And there was some residue of that in my interaction with them. It's like, what are you stressed out about? What are you annoyed about? What are you pissed off about? What

can't you get out of your head? What is the thing that you now feel like you need to spend the next week of your life

04:05:42 focused on because it went so sideways for you? All of that was Twitter. I mean, literally 100% of that was Twitter. And so I just, at one point, it was actually on Thanksgiving day, I just looked at this and I just-- I mean, there was very little thought went into it. I mean, literally, there was more thought involved in whether I wanted coffee when you asked me when I showed up here. I mean it was just like, at a certain point I just I just saw it, and I just ripped the Band-Aid off. And to answer your other question,

04:06:15 it's been almost wholly positive, as you might expect given the litany of pain and discomfort I just ran through. But I mean, it's surprising to recognize how much of a presence it was in my life given the sense of what is now missing. I mean, there's no question there's an addictive component to it. And when you see-- I mean, like when I look at what Elon is doing on Twitter, forget about his ownership of it-- I've got a lot to say about the choices he's making for the platform, but just his personal use of it

04:06:55 is just so obviously an expression of-- I mean, I don't know if addiction is the clinically appropriate term, but his dysfunctional attachment to using the platform. Again, forget about changing it and owning it, but just the degree to which it is pointlessly disrupting the life of one of the most productive people in any generation. That was also instructive to me because I know Elon, and from a friend's eye view of the situation, it's so obviously not good for him that he's spending this much time on Twitter.

04:07:45 I just brought that back to me. It's like, well, if it's not-- if this is what it's doing to Elon, and he's got all these other things he could be doing with his attention, how much of my use of Twitter is actually a good idea and optimize to my well-being and the well-being of the people around me? So anyway, there was an addictive component to it I think, and so when that got stripped off, I do notice that there's-- I mean, there are times I pick up my phone and I realize this is like the old me picking it

04:08:17 up my phone for a reason that no longer exists because there's not that much-- I have a Slack channel with my team, and I've got email, obviously, but it's like, that is not much of what I was doing with my phone really in the end. And so it's just my phone is much less of a presence in my life. And so it's almost wholly good, but yeah, I think there is some danger in-- or some possible danger in losing touch with certain aspects of culture, which, again, I'm not even sure-- I mean, there's this question of how much is Twitter real life,

04:08:53 and how much is it just a mass delusion? I don't know. But insofar as it actually matters what happens on Twitter, or insofar as I was actually getting a news diet which I'm not going to be able to recapitulate for myself, or I'm just not in fact going to recapitulate for myself even if I could, if any of that matters, I haven't discovered that yet. I mean, it was taking up an immense amount of bandwidth and it's impressive. I think I said, it was like I amputated a phantom limb. It was not a real limb, but it was this continuous presence

04:09:31 in my life that-- it's weird, it actually relates to the concept of self in surprising ways because I felt there was a part of myself that existed on Twitter. And I just performed a suicide of that self. This is ending right now, there's no residue, there's nothing to go back and check, it's gone. And I didn't go back and look at my-- what's interesting to consider is that I'd been on Twitter for 12 years. I don't keep a journal. I mean, Twitter, in my timeline would have been a kind of journal.

04:10:08 I could have gone back to a specific hour and a specific day and looked at what I was paying attention to. I mean, that could have been an interesting record of just who I've been for a decade, and probably a pretty humbling record of who I've been for a decade in terms of the kinds of things that captivated my attention. I didn't even think to go nostalgically just look at any of that, or see if any of it was worth saving, or archiving, or thinking-- I just-- delete. And so my actual sense of who I am and my engagement

04:10:44 with my audience, the world of people who could potentially know me. What does it mean to have a platform? Where do I exist, digitally? My sense of all of that got truncated in a way that is much less noisy. I mean, it's amazing how much can't get fucked up now in my life. It's like with Twitter, almost anything could happen. The next tweet was always an opportunity to massively complicate my life. There is no analogous space for me now. And so it's what I'm going to say on your podcast, what I'm going to say on my own podcast, what

04:11:31 I'm going to write next. That's much more deliberative and the opportunities to take my foot out of my mouth or to reconsider whether any of this is worth it. Is this the Hill I really want to die on now. It can be much more considered. I mean, I think all of that's to the good. But even more important than that is there's not-- I'm not getting this continuous signal that is always inviting a response, whether on Twitter, or on my own podcast, or anywhere else. And it's just much less noisy. I mean, life is much less noisy and cluttered.

04:12:19 And that definitely feels better. That's 100% better. ANDREW HUBERMAN: I'm happy to hear that. I know a number of people miss you there, but you sound happy. I sense the genuine happiness. And several things come to mind-- first of all, thank you for sharing your rationale there and how it went. I think for a lot of people they think, oh, you must have walked around in circles for

hours talking about whether it was delete, as many good decisions are executed. I'm a big fan of Cal Newport's work, deep work.

04:12:53 In many ways, Cal's-- I've never met him, but we know each other through the internet space. He's really ahead of his time with this notion of deep work and limiting distractions. I think he's even got a book about a world without email or something, really extreme. SAM HARRIS: So I mean, he deserves some credit because he had been somewhat a proximate cause to this. He had been on my podcast, and he had encouraged me to delete Twitter because I had been I had been reaching some kind of crisis point with it prior to that podcast

04:13:26 and so we talked about it. And I had recorded that podcast but hadn't released it. I actually recorded the podcast the day before I wound up deleting Twitter, but I hadn't yet released it. So in my podcast with him, in the intro to it, I then give a post-mortem on my deleting it. But he was one of the last people who was in my head around these issues. And actually, it was not by accident I had invited him on the podcast because I increasingly wanted to think about whether this was totally dysfunctional.

04:13:55 ANDREW HUBERMAN: Well, I'm a big fan of Cal Newport. And I am on social media. I'm on Twitter. I had some high-friction interactions there, and I have a process for dealing with those. I tend to avoid high-friction confrontations online. But Instagram is a much friendlier place by the way. If you want to come over to where the nice kids-- the cool kids actually hang out-- SAM HARRIS: Strangely, I'm not looking for a substitute. ANDREW HUBERMAN: Don't let me entice you over there. But I think that this notion of really

04:14:27 being able to access what Cal calls deep work, what Rick Rubin talks about being able to touch the source of great creativity and focus on a regular basis, does require that one have certain types of, and in some cases, zero interaction with certain platforms. That merely being on a platform and blocking people that just won't provide. I think a lot of energy opens up. And I'm fascinated by this concept of energy. I mean, we only have so much energy, neural energy, to devote. And in many ways what you described,

04:15:00 there's really I think striking parallels to what we've been talking about all along these last hours, which is that sometimes the thing that feels so powerful, that has such a gravitational pull, and that we think this is experience, this is life, this is just the way it is, actually is an illusion. And when you step away from it, you realize that there's this whole other dimension of interactions that was available all along but that we, for whatever reason, were intervening in by way of our reflexive, distracted

04:15:30 behavior. So I think there's a poetry there. SAM HARRIS: I was a hard case, but yeah, I got religion on this point, and it's a good change. ANDREW HUBERMAN: Well, Sam, I want to say a couple of things-- first of all, every time you talk I learn so much, and that's in the dimensions of neuroscience, even hard core neural circuitry type stuff, which is my home. When you talk about philosophy, or meditation, or psychedelics, and even politics, a topic that I'm woefully undereducated in, but you have this amazing ability to blend and synergize

04:16:15 across things. And I think, today, what occurs to me is that not only is that no accident because of your training, and the rigor, and the depth at which you've explored these different topics, but also your openness to it. But I think, at least for me, above all it's because I think you are able to encapsulate this idea of the self and the different ways in which we each and all can potentially interact with the environment and our inner landscape. Your description of meditation, I have to say,

04:16:45 now has forever changed the way I think about meditation. I would no longer just think of it as a perceptual exercise. On the podcast, I've been talking about it as something to do for these various benefits, the benefit set of more focus, lower stress, of which certainly exists. But what you describe today, has such an allure and holds such a promise that, as I mentioned, I'm certainly going to change my behavior. And I know I'm speaking on behalf of many, many people, when I just want to extend my thanks for your coming here today

04:17:20 to teach us even more because, of course, you have your podcast and the app, the Waking Up app. And the fact that, regardless of the political landscapes, regardless of what neuroscience feels about psychedelics, or where things are at any point in time, you strike me as somebody who is very committed to sharing knowledge and thoughtful deep discourse so that people can benefit. And there are very few people like you. In fact, there's probably only just one. And so I feel very grateful to be sitting across the table from him for these last hours.

04:17:57 SAM HARRIS: Oh, nice, nice. Well, I really enjoyed this, and I want to congratulate you on what you've built here because your podcast is everywhere, and I'm a fan. And even more than that, I'm continually seeing the evidence of you reaching people and benefiting people, and this is one of the best examples of new media just carving out a space that people didn't really know existed because this is not television, it's not radio, it's not-- and all of a sudden, people have time to hear a conversation of great length

04:18:35 that goes into nitty gritty scientific detail on hormones. I mean, who would have thought that was even possible? And so, yeah, I would just-- congratulations, it's fantastic to see. And I'm just very happy for the opportunity to talk to you and your people. ANDREW HUBERMAN: Well, thank you, it's very gratifying to hear. And I feel very blessed, in no small part because of our

conversation today. Thank you so much. SAM HARRIS: Nice, well, to be continued. ANDREW HUBERMAN: To be continued. We'll do it again, and again, and again.

04:19:03 Thank you for joining me today for my discussion with Dr. Sam Harris. I hope you found it to be as enlightening as I did. And be sure to check out the Waking Up app that Dr. Sam Harris has made free to any Huberman Lab listeners for 30 days by going to wakingup.com/huberman. Please also check out his incredible podcast, the making sense podcast. And you can find any number of Sam Harris's different books on meditation, consciousness, philosophy, neuroscience, politics, and more. You can find links to those books

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04:20:25 and performance. The Huberman Lab podcast is proud to announce that we are now partnered with Momentous Supplements because Momentous Supplements are of the very highest quality, they ship internationally, and they have single ingredient formulations, which turns out to be important if you're going to develop the most cost effective and biologically effective supplementation regimen. If you'd like to access the supplements discussed on the Huberman Lab podcast, you can go to livemomentous spelled

04:20:48 O-U-S, so livemomentous.com/huberman. If you're not already following us on social media, we are Huberman Lab on Instagram, Twitter, LinkedIn, and Facebook. And all of those places I talk about science and science related tools, some of which overlap with the content of the Huberman Lab podcast, but much of which is distinct from the content of the Huberman Lab podcast. Again, it's Huberman Lab on all social media handles, all platforms-- Instagram, Twitter, Facebook, and LinkedIn. If you haven't already subscribed

04:21:14 to our Neural Network Newsletter, that's a monthly newsletter, it's completely zero cost and includes summaries of podcast episodes as well as toolkits for things like enhancing your sleep, enhancing your focus and ability to learn, hormone support, fitness, and on and on. You simply go to hubermanlab.com, go to the menu, click on the menu and scroll down to newsletter, provide your email, and you can start receiving our monthly Neural Network Newsletter. Thank you once again for joining me for today's discussion

04:21:41 with Dr. Sam Harris all about meditation, and consciousness, free will, psychedelics, social media, and much, much more. And as always, thank you for your interest in science. [MUSIC PLAYING]

00:00:00 ANDREW HUBERMAN: Welcome to the Huberman Lab Guest Series, where I and an expert guest discuss science and science-based tools for everyday life. [MUSIC PLAYING] I'm Andrew Huberman and I'm a professor of neurobiology and ophthalmology at Stanford School of Medicine. Today's episode marks the first in a series with Dr. Andy Galpin. Dr. Andy Galpin is a professor of kinesiology at Cal State University Fullerton and one of the foremost world experts on the science and application of methods to increase strength, speed, endurance, hypertrophy,

00:00:32 and various other aspects of fitness, exercise, and sports performance. Across this six episode series, Dr. Andy Galpin pulls from his expertise working with everything from professional athletes to recreational exercisers and teaches us the mechanisms, logic, and specific protocols for how to achieve any of the number of different exercise adaptations that I mentioned a moment ago, ranging from strength to endurance, hypertrophy, and everything in between. We get really far into details, but at all times paying

00:01:01 attention to the macroscopic issues. That is, how to create a program for endurance or strength or hypertrophy or speed, or one that combines all of those. We also talk about supplementation and nutrition and how to maximize recovery for each of the different types of exercise adaptations. During today's episode, Dr. Galpin teaches us how to assess our level of fitness and, more generally, how to think about fitness so that we can best achieve our fitness exercise and performance goals. Dr. Professor Andy Galpin.

00:01:31 Super excited to have you here. You're such an immense treasure trove of information on physical training and optimizing for specific goals and outcomes with physical exercise. I'm curious, however-- so many people have different levels of fitness. Some people are professional athletes, of course, but most people are not. Many people exercise regularly. Some people are trying to do that more. Some people are doing too much of that; they're overtraining, they're not recovering enough. If we were to take a step back and each and every one of us

00:02:06 ask how fit are we, with the word fit, of course, being a very broad encompassing word, could encompass endurance, certainly it does, strength, the ability to run fast, even if for short distances, it might even include hypertrophy or directed hypertrophy, trying to balance one's musculature to offset asymmetries, recover from injuries, et cetera. How should I, or anyone else for that matter think about their level of fitness? I know my resting heart rate, but what do I do in terms of really assessing whether or not

00:02:45 I'm as fit as I could be and should be both for sake of health and performance? And here I'm asking you the question not as an athlete, but as somebody who's been pretty consistent as an exerciser. But if we were to throw our arms around this question of how do we assess our fitness, what would be the different levels of assessment that we should think about and do? ANDY

GALPIN: When it comes to exercise, people generally have two major goals in mind. Goal number one is achieving some sort of appearance.

00:03:17 Right? This is I want to be big, or I want to not be too big, or I want to be lean. Something, right? It doesn't matter what that goal is, but there is an aesthetic component to almost everybody. They want to look a certain way or not look a certain way. The other one is functionality. So I want to be able to perform a certain way. Now, again, that definition differs per person. So I want to be better at strength, I want to be better at mobility, I want to be able to have energy throughout the day, whatever

00:03:40 it is. So there's some sort of appeal to aesthetic and there's some sort of appeal to functionality. So within both of those categories, we want to be in a position where we can understand, where do I need to go with my exercise training so that I can be as fit and as healthy and achieve these goals that I want now, as well as be in a position where I can maintain them for a long period of time. So this blends both immediate goals. So say you're just interested in squatting a lot of weights. Say you're interested in running a 5K time the best run.

00:04:13 It doesn't matter. It blends that with the desire to have a long wellness span, to be fit throughout life, to achieve all those things for as long as possible. So then the question kind of comes back to saying, well, how do I know which area I need to focus on the most, and why am I not achieving these goals, or how can I get there more effectively. And if we look at the big picture, we have to understand that there are several major components to physical fitness that are going to be required in all of these categories.

00:04:42 And to achieve that, there are a handful of components that have to happen to be able to hit those goals. Now there are infinite methods. So the saying we actually use here a lot is, the methods are many, but the concepts are few. So what I'd love to do today is, over the course of our discussion is hit exactly what those concepts are and then cover a whole bunch of different methods. And we could do that for hours. But we'll cover a number of them for various goals.

ANDREW HUBERMAN: So one of the reasons

00:05:07 I went into neuroscience and not into exercise science is because of this thing neuroplasticity, the nervous system's ability to adapt. But the more time I spend with you and the more I learn from you, I realize that many, if not all of the organ systems of our body have this incredible ability to adapt. And when we're talking about physical exercise, there are incredible adaptations that, of course, involve the nervous system, but also involve muscle and connective tissue and so many other cell types and tissues.

00:05:39 That said, when we talk about fitness, what are the major types of adaptations that underlie this thing that we call fitness? And later, I know we're going to get into how different forms of exercise can trigger different types of adaptations, but what are the major adaptations that one can create in their body using exercise? ANDY GALPIN: There are many reasons why one should exercise, and we could perhaps cover that later in our chats. But the physiological adaptations can be bucketed really in nine areas.

00:06:12 So the very first one is what I call skill or technique. So just learning to move better, more efficiently with a specific position and timing and sequence, or whatever that is. This could be running more effectively, this could be practicing a skill like shooting a ball or an implement, swinging a golf club. Anything like that, I call that skill development. The second one is speed, so this is simply moving at a higher velocity or with a better rate of acceleration. That's very similar to the next one, which is power.

00:06:42 And power is speed multiplied by force. The next one then, of course, on top of that, is force or strength. So those are really synonymous terms. How effectively can you move something? Now, this is often confused-- strength, rather-- as muscular endurance. So what I mean by that is strength truly is a marker of what's the maximum thing you can move or what's the maximum amount of force you can produce one time. It's not how many repetitions in a row you can do. That's actually another one of our adaptations

00:07:14 called muscular endurance. So that is typically under the order of say five to 25, maybe 50 repetitions. Think of a classic how many push-ups can you do in a row? How many sit-ups can you do in a minute? Things like that are muscular endurance. Muscular endurance tends to be localized, so this is specific to just, say, your triceps and your deltoids. It's not a overall cardiovascular endurance marker or anything like that. So that's strength, number four. Number five is muscle hypertrophy. And this is the first time now we're

00:07:46 talking about an appearance rather than a functional outcome. So moving better, moving faster, and moving heavier are indicators of how well you can move. This is the first one that's just simply how big is your muscle? And that's muscle hypertrophy or muscle size. After that is muscular endurance. So this is how many repetitions you can typically do of a movement. So think of how many push ups in a row you can do, how many sit ups in a minute you can do, things that are typically in five to 50 repetition sort of range.

00:08:19 And it is often or it is almost always local muscle. So what I mean by that is a push-up test is really how many reps that your triceps and pecs and deltoids can do. It is not a cardiovascular endurance. It is not a global physiological endurance. It's specific to, typically, one or a few muscle groups at a time. And this is why you have to do multiple tests for every group there.

After that, now we've moved into number seven, which is what I call anaerobic capacity. This is more synonymous with maximum heart rate.

00:08:52 And now we're actually looking at, rather than a single movement or muscle group, it is a total physiological limitation. So it is the maximum amount of work you can do in, say, 30 to 45 seconds, maybe even up to 120 seconds, of all-out work. Think of your classic interval type of stuff here. So how much work can you do at a maximum rate, where you're going to enter tremendous amounts of global fatigue? The next past that is maximal aerobic capacity. And this is probably actually something like in the eight to 15 minute range, where you're

00:09:28 going to reach probably both a maximum heart rate as well as a true VO₂ max, which we'll talk a lot more about what that is later. So that is different from the previous one, where you can't reach this in a matter of seconds. It simply takes multiple minutes to get to a position to where your VO₂ max is actually going to be sufficiently challenged or an indicator there. And then the last one, number nine, is what I call long duration. And this is just your ability to sustain submaximum work for a long period of time with no breaks,

00:10:02 no reduction whatsoever. This is often called steady state training or a lot of people just think of this when they think of, quote, unquote, "cardio," but your ability to continue to move without any breaks or change or drop is the last and final adaptation. ANDREW HUBERMAN: And for long distance steady state, I'm guessing it exceeds 15 minutes because-- ANDY GALPIN: Correct. ANDREW HUBERMAN: --the previous one was eight to 15 minutes or so. What sort of rate ranges are we talking about in terms

00:10:30 of this long duration? ANDY GALPIN: Well, that's actually wonderful. You're going to be anything past 15 minutes. So really, if you look at a minimal number there, it's generally 20 minutes of what we're looking for, but a more typical would be 20 to 60 minutes. But anything past that would still be limited by your long-duration endurance, so your ability to sustain work over time. ANDREW HUBERMAN: OK. So given that there are nine different major adaptations that can be induced with exercise of specific types,

00:10:56 is there any one global test or assessment that people can take or do that allows them to determine what level of ability, of fitness they have in each and every one of these nine different categories? ANDY GALPIN: There are probably dozens or more tests that you can do for each one of those nine categories. And what I would actually like to do is walk you through my favorites for each and giving you both the scientific gold standard-- so if you have the ability, unlimited resources, what should you go do?

00:11:26 As well as some that are equipment-free, that are cost-free, things that anyone can do across the world. In addition to that, I want to walk you through what those numbers should be, how do you identify if you're really poor in something or if you're great. And then if you aren't as good, maybe, in a category and you want to get better at it, exactly what to do in terms of protocols for how to achieve optimal results in each of those steps. ANDREW HUBERMAN: So I noticed in your list of the nine

00:11:51 different adaptations to exercise that you did not mention fat loss or health-promoting benefits, which are two reasons that a lot of people exercise. Was there a specific reason that you did not mention those? ANDY GALPIN: Absolutely. It's because those things are actually not specific training styles. They are byproducts of these nine. So what I mean by that is if you understand how fat loss occurs, which we can certainly talk about, you'll realize some of these nine protocols are effective for fat loss and some are not.

00:12:24 General health is the same thing. When we understand what it actually means to be healthy from a physiological perspective, then the rationale for what to train for is going to determine itself. So what I mean is, looking at things like, in order to be healthy, you have to have sufficient strength, you have to have cardiovascular fitness, and you have to have sufficient muscle and et cetera. Therefore, training for one's health is determined by those restrictions. So for you, Andrew, you may need to do more strength training

00:12:55 to be healthy, where me, because I'm strong already, way stronger than you, I may not need to do as much strength training. So our, quote, unquote, "health-based protocols" are based on our current status or limitations in physical fitness among these nine areas. So what I would like to do today is to cover a brief history of exercise science. And the reason is it's going to explain a lot about why people are not getting the goals in their exercise programs that they want as well as gives you very specific direction about what to do instead.

00:13:26 ANDREW HUBERMAN: I can't wait to hear all the things that I'm doing incorrectly and to have you help me remedy that. Before we begin, I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford. It is also separate from Dr. Galpin's teaching and research roles at Cal State Fullerton. It is, however, part of our desire and effort to bring zero cost to consumer information about science and science-related tools to the general public. In keeping with that theme, we'd like

00:13:50 to thank the sponsors of today's podcast. Our first sponsor is Momentous. Momentous make supplements of the absolute highest quality. The Huberman Lab podcast is proud to be partnering with Momentous for several important reasons. First of all, as I mentioned, their supplements are of extremely high quality. Second of all, their supplements are generally in

single-ingredient formulations. If you're going to develop a supplementation protocol, you're going to want to focus mainly on using single-ingredient formulations.

00:14:17 With single-ingredient formulations, you can devise the most logical and effective and cost-effective supplementation regimen for your goals. In addition, Momentous supplements ship internationally. And this is, of course, important because we realize that many of the Huberman Lab podcast listeners reside outside the United States. If you'd like to try the various supplements mentioned on the Huberman Lab podcast, in particular supplements, for hormone health, for sleep optimization, for focus,

00:14:40 as well as a number of other things, including exercise recovery, you can go to livemomentous-- spelled O-U-S-. So that's livemomentous.com/huberman. Today's episode is also brought to us by LMNT. LMNT is an electrolyte drink that contains the exact ratios of the electrolytes sodium, magnesium, and potassium to optimize cellular functioning for mental and physical performance. Most people realize that hydration is key. We need to ingest enough fluids in order to feel our best and perform our best, but what most people do not realize

00:15:08 is that the proper functioning of our cells, and nerve cells, neurons in particular, requires that sodium, magnesium, and potassium be present in the correct ratios. Now, of course, people with prehypertension and hypertension need to be careful about their sodium intake, but what a lot of people don't realize is that if you drink caffeine, if you exercise, and, in particular, if you're following a very clean diet, that is not a lot of processed foods, which, of course, is a good thing, chances

00:15:34 are you're not getting enough sodium, potassium, and magnesium to optimize mental and physical performance. LMNT contains a science-backed ratio of 1,000 milligrams-- that's 1 gram of sodium, 200 milligrams of potassium, and 60 milligrams of magnesium, and no sugar. If you'd like to try LMNT, you can go to drinkLMNT.com/huberman to get a free LMNT sample pack. With your purchase. Again, that's drinkLMNT.com/huberman to claim a free sample pack. Today's episode is also brought to us by Eight Sleep.

00:16:04 Eight Sleep makes smart mattress covers with cooling, heating, and sleep-tracking capacity. I've been using an Eight Sleep mattress cover for about the last eight months, and it has completely transformed my sleep. I'm sleeping about the same amount, but I'm sleeping far deeper, and I'm now getting the proper ratios of so-called rapid eye movement, or REM sleep, and slow-wave sleep and waking up feeling far more recovered mentally and physically. The underlying mechanism for all that is very straightforward.

00:16:29 I've talked many times before on this podcast and elsewhere about the critical relationship between sleep and body temperature, that is, in order to fall asleep at night, your body needs to drop by about one to three degrees in terms of core body temperature. And waking up involves a one to three degree increase in core body temperature. With Eight Sleep mattress covers, you can adjust the temperature of your sleeping environment to be one temperature at the start of the night, a different temperature in the middle of the night,

00:16:54 and a different temperature as you approach morning, each of which can place you into the optimal stages of sleep and have you waking up feeling more refreshed than ever. If you'd like to try Eight Sleep, you can go to eightsleep.com/huberman and check out their pod three cover and save \$150 at checkout. Eight Sleep currently ships in the USA, Canada, United Kingdom, select countries in the EU, and Australia. Again, that's eightsleep.com/huberman to save \$150 at checkout. Before we get into how the history of exercise science

00:17:23 informs the mistakes that we are all making and how to remedy those mistakes, I'm curious as to whether or not you have any favorite one or two studies that point to a naturally occurring example of how people can become very fit in one area and not another. I'm familiar with seeing endurance athletes that apparently have terrific endurance but, at least to my eye, don't look like they are particularly strong. I'm also familiar with seeing individuals that are very, very strong, particularly on social media,

00:17:55 but that don't look like they could walk up a flight of stairs, much less run a mile. Do you have any examples of studies in or outside the laboratory that point to that in a concrete way? ANDY GALPIN: There's a lot to discuss here, but I'll answer really clear. If you look across the literature-- and this is actually back to as early as the mid 1950s. In fact, it actually goes back previous to that, to the Harvard Fatigue Lab, 1927 to 1947 area. People actually were advocating, at that point, a combination of strength training and endurance.

00:18:26 ANDREW HUBERMAN: In the 1920s? ANDY GALPIN: Way back then. In fact, it actually goes prior to that. In the late 1880s, there is scientific evidence back then. It became more well-developed in the mid 1950s and '60s. In fact, there was the initial stages of what's called the Exercise As Medicine Movement, which is the movement now, but the initial stages of that actually route back to the 1950s. And I could actually go into that whole discussion and the story of how that all came about, but that's the Health Is Wealth mantra

00:18:54 that came from the 1950s, from the scientific community then. All those data points are going to suggest you need a combination of some sort of broad strength training and broad endurance. Now, if you have a specific goal five months from now, you want to compete in a race or hit a certain physique thing, that's fine to focus on one area of training. Certainly, if you're an

athlete, that's different. But if you want to maximize health and overall functionality throughout time, it needs to be a combination.

00:19:21 And to really, really highlight this, I can actually talk about a couple of studies that I've done. One of them we actually did in Stockholm, Sweden. So I did this at the Karolinska Institute, which you probably are aware of. It's actually one of the founding places of all of exercise physiology. Generally, it started there. It was called something different back then, but really, our entire field came out of Stockholm and the Karolinska Institute. And we worked with a whole bunch of cross-country skiers

00:19:48 that were in their 80s and 90s. And so they were competitive skiers in the 1940s and '50s, and they had been skiing competitively for that entire duration. So you're talking 50 to 60 consecutive years of competing. So these are 80 to 90-year-olds, living alone and healthy. And we compared them to a group of individuals here in America who are the same age but were not exercising. And what we wanted to do is to see and of look at, what are these lifelong endurance individuals? What do they look like?

00:20:15 And when we brought them into the lab, which is, by the way, amazing, to do a VO2 max test on a 92-year-old, especially in a language that they don't speak, you can imagine, you're doing this in the hospital. And you're running people through, this is a cycling task. And so for a VO2 max test, you have a mask on your face, you're hooked up to a metabolic cart so we can collect all the gases that are coming out of your mouth, and you're chanting these people on. And basically, every minute, the workload

00:20:41 gets harder and harder and harder until you can't complete it. And we're doing this in a cardiology center, and the cardiologists are usually waiting for their heart rate to get slightly elevated and they stop them because they're 85, 86 years old. And not only are we not stopping them, but we are screaming in their ears, just go, go, go. ANDREW HUBERMAN: In Swedish or English? ANDY GALPIN: In English. And then the translator-- but it doesn't take a lot of translation when someone's screaming at your face, go, go, go.

00:21:09 So we ran them through a whole bunch of VO2 max tests. And we did the same thing for those folks back here in America. And what was incredibly clear from that study was the VO2 max-- you can think about these numbers, and this is what's called relative. And the relative terms are milliliters per kilogram per minute. And so a standard number is about 18, is what we call the line of independence. So if your VO2 max is below 18 milliliters per kilogram per minute, it's very hard for you to live by yourself.

00:21:36 So your fitness is so low, you probably are going to need to have somebody living with you or you'll need to be in some sort of assisted living home. So if you are in a VO2 max of 20 or 21 or 22, you're not below that line of independence, but you're on that threshold. And so what we found was our folks here in America, the group average was right around that number. So they were living at home, by definition. We picked them to be people living by themselves in their 80s and not in a living home,

00:22:03 but they didn't have any bandwidth. So if they got a cold or they had anything pop up where they lost a little bit of fitness, they were going to drop below that line and would probably have to go to some sort of assisted living situation. The folks in Stockholm, the cross-country skiers, the group average was much closer to 35 to 38 milliliters per kilogram per minute. Now, that number is about the VO2 max you would find for a normal college male. And so these folks that were literally 80 or 90--

00:22:34 the joke, if a sabertooth tiger ran in the room or whatever and it chased it down and we all had to run to see who didn't get eaten alive, the college men would probably have gotten eaten before the 90-year-olds. And in one case, we had a 92-year-old individual. And I think his VO2 max was 38, which was, in our estimation, a world record, the highest VO2 max for somebody over the age of 90. ANDREW HUBERMAN: May I ask what is the typical resting heart rate for somebody very fit, like these older

00:23:04 Swedish cross-country skiers? If somebody has-- let's say their number is 35 millimeters per kilogram in this VO2 max test, but since most of us don't have access to that kind of equipment, but we can measure our pulse rate. ANDY GALPIN: Yeah. ANDREW HUBERMAN: What was a typical resting heart rate, resting pulse rate? ANDY GALPIN: Sub 60. ANDREW HUBERMAN: Sub 60. ANDY GALPIN: Yeah. I mean, typically that's a good number to go off of for anybody, regardless of age. Any time I see somebody above that,

00:23:31 I'm going to start asking questions. Certainly above-- you'll see in the literature people will say 60 to 80 is normal, and I don't agree with that at all. If your resting heart rate is 75 beats per minute, there's either something going on or you're not fit. ANDREW HUBERMAN: How much cross-country skiing were they doing, on average, in the previous, let's say, if we take the previous 20 years since they'd been longtime cross-country skiers. Divide that by 20 years. ANDY GALPIN: Yeah, ANDREW HUBERMAN: On average, are these people cross-country

00:24:00 skiing five hours a day, two hours a day, an hour a day? ANDY GALPIN: Yeah, that's actually a good question. I don't remember. It's been many years, but they were not doing it every single day. And the volume would not have shocked you. It was the consistency over 50 years that got them there. Now, obviously, these people were, again, world champions and Olympic gold

medalists in the 1940s and '50s, so they were elite. They just continued consistently over time, but it wasn't a shocking amount of physical fitness.

00:24:25 They also didn't go out of their way to train hard. They were busy chopping wood. They were busy doing a number of other things. And then they just happened to do some of these races and ski along the way, but it wasn't a crazy amount too where you're like, oh, that's great, but I could never hit that number. It was something much more reasonable. ANDREW HUBERMAN: So is the takeaway to be consistent about getting cardiovascular exercise? And we can define what "consistent" means in terms of days per week a little bit later,

00:24:52 and I know we will. ANDY GALPIN: Yeah. ANDREW HUBERMAN: What are some other examples? I love these examples from the real world. ANDY GALPIN: So here's the downside, though. So I only told you about the VO₂ max. What I didn't tell you about is their leg strength and functionality. And that part was no more superior than it was their counterparts who were not exercisers. So what that showed really, really clearly-- and many other studies have been done since then that look at the classic, what we call

00:25:20 lifelong endurance exercisers. You will see, in general, their VO₂ max, their cardiovascular function, their resting heart rate, their blood pressure. It will be markedly healthier than folks who don't exercise. It is extraordinarily clear that type of exercise is very important for chronic disease management, no doubt about it. However, it is not sufficient for overall global health because it does almost nothing for leg strength, for any other marker of health, which we can talk about, what are the things that are actually

00:25:50 going to predict mortality, morbidity than most. So was a big smashing indication that's like, hey, this is great. However, you're leaving things on the table for your overall health. Now, one could argue, they're 80, and they're doing pretty well, but they weren't doing as well in these areas. And so a study we did later, actually, as a follow-up was looking at monozygous twins. So this is actually interesting. Being a scientist, this is a classic example of one of my graduate students who had been in my lab

00:26:21 for probably three or four years. And she was in our single fiber physiology lab. And you can imagine, she's isolating individual muscle fibers, from an athlete, one by one with a tweezer. And she's going to do several thousand individual cells. So you're down there for hours, and things happen down there. You kind of lose your mind. And she was going on one day with one of my colleagues and just talking, and she's like, oh yeah, my uncle is really, really fit and something or other and then. Oh yeah, he's a twin.

00:26:51 And I was like, oh, is he a monozygous? And she's like, yeah. ANDREW HUBERMAN: For those that don't know, monozygous are identical twins. ANDY GALPIN: Yeah, which is interesting. So you basically have-- what I'm setting up here is this is the perfect exercise scientific experiment. Monozygous, identical twins mean they have the exact same DNA. So an egg was fertilized, split, and then two humans grew out of that with the exact same DNA. And so now we can start answering the question, well, yeah, OK.

00:27:15 What about, maybe, these cross-country skiers? Maybe they were just genetic freaks. Maybe it didn't matter. It's like some people have-- well, genetics are always a component to it, but how much? Well, now we have a scenario lining up where it's like, wait a minute. You have monozygous twins. So we have a replica of a human being, exact same DNA. The only differences that we would see in their physiology now would be due to lifestyle circumstances. Interesting. So monozygous twin dad and uncle, right?

00:27:41 Uh-huh. Great. Do they exercise? Well, one of them does. He's a lifelong endurance exercise, runner, cyclist, swimmer, Ironman, all these things. What about the other one? Nope. He doesn't exercise at all. And at that point, I wanted to kill my graduate student because I'm like, you've been in my lab for three years or more, probably, and you've never told me that in your household is the perfect scientific experiment for exercise you could ever create. And Jesus, the look on her face when my colleague and I

00:28:13 were staring at her. She's just like, oh my god. So I'm like, call them right now. They are coming into the lab. Fly them in from Chicago. I don't care what we have to do. We're getting them in. And so I wanted to-- actually, going back to the model that was first developed by the Harvard Fatigue Lab, one thing that's interesting about that community is they started off with the concept of trying to examine human performance through a holistic lens. And so it was the antithesis of looking at either organ

00:28:39 by organ, so we're going to only look at the cardiovascular system. We're only going to look at skeletal muscle. And then we're saying, we're looking at this entire picture. And so that model, we wanted to carry through in these twins. And I said, all right, I want to bring them in the lab, but I'm not just going to look at one system. I want to do everything. So we took stool samples. We took blood. We did vertical jump tests. We did maximum strength tests. We did MRIs of muscle mass. We did VO2 max tests.

00:29:06 We did efficiency stuff. We did genetic testing. We did an IQ test. We did psychological battery. We wanted to look at everything to figure out of these things, what differ between the twins? And if so, the second key question there is, by how much? So can I improve my VO2 max? Sure. Everyone knows that, but how much? Can it change by 5%, 80%? Where is the

number? And so putting some quantification on this was very important. And so again, we had another example of a classic endurance-only training paradigm

00:29:36 compared to a non. So this is a person who's, I think, he's truck driver by vocation. I think, actually, he drove for a potato chip company, which was even funnier. The endurance athlete actually was great because, like any endurance people, he had physical books of all of his training mileage for the last 35 years. And we just went through them, and we calculated the total amount of miles he ran, his averages, his heart rates per time. We had this unbelievable thing, what races he was in. He had the documentation.

00:30:04 He was just totally nuts, something that endurance people are like shaking their head right now going, oh, yeah. I got that too. ANDREW HUBERMAN: And endurance folks are pretty nerdy. ANDY GALPIN: Yeah. Super nerdy, right? So it was great because now we could validate, as close as one could, to actually how much you ran and things like that. So they had about a 35-year discord. They both exercised up through high school. About 18, they stopped doing it, and by the time I got them in the lab, they're in their mid-50s.

00:30:28 So it was about 35 years of difference. And when we ran them through the testing, if you look at the measures that were similar to the Sweden study, it was almost identical. The exercising twin was significantly better at things like a lipid panel, resting heart rate, blood pressure, VO2 max. Any of those markers, as predicted, were much better. What was very interesting, though, was the things that were in the middle. First of all, their total amount of muscle mass was almost identical, to the gram,

00:30:59 within the margin of error of a DEXA scan could possibly ever be. The non-exerciser, though, was a little bit fatter. So the difference in actual body weight was explained almost entirely by body fat or non-lean tissue, really, same sort of deal. So OK. No one's surprised there that the exerciser was a little bit leaner, even though it didn't change total amount of muscle mass at all. When we looked at some of the more functional tests and we looked at things like muscle quality-- so this is a metric you can get from an ultrasound.

00:31:28 You can kind of think about this as how much fat is inside the tissue, which is sometimes an advantage for an endurance athlete to have a little bit more of what are called intramuscular triglycerides because it's a fuel directly in the tissue. But in general, the muscle quality he was not in favor of the exerciser. If you looked at the performance testing and if you looked at strength, it favored the non-exerciser. And so now, again, we have the same finding we saw in our Sweden study, but in identical twins.

00:32:00 And so it really, really highlighted the fact that if you want to move forward with optimal health, simply picking one silo is not going to get you there. ANDREW HUBERMAN: One silo meaning just running, just cycling? ANDY GALPIN: Right. ANDREW HUBERMAN: Does this mean that the twin that did not exercise could jump higher or win an arm wrestling competition? Not that that's a vital thing to be able to do, but just in terms of measuring strength, it's our isometric strength. Was the non-exercising twin stronger or at least as strong

00:32:32 as their exercising twin? ANDY GALPIN: Yes, particularly in grip strength. Yeah. And any of the measures like the vertical jump, leg extension power, and a number of things, they often favored the non-exerciser, which you're still a little bit of a chicken and egg. You don't know if, necessarily, the endurance training reduced that other twin's strength. It doesn't even really matter, per se. I think the highlight of it is, can you change some of these metrics of VO2 max? Yeah, not even close. These things are very responsive regardless of your genetics.

00:33:02 Your genetics will give you a starting place very clearly. Even the non-exerciser was a pretty healthy guy. So they were in a good spot. Mid-50s, doesn't exercise, doesn't really pay attention to his diet at all, and he was in a pretty good shape. However, if you want to actually move progress and move forward high functionality, you have to do something besides just run, just distance run. Now, I could say the same thing for strength training. That alone-- because I don't want to make this thing like I'm saying endurance exercises.

00:33:34 It worked. In both cases, both these studies, those folks were much better off in metrics that are incredibly important to mortality, how long you're going to live, VO2 max, et cetera. It's just not going to get there in terms of strength. We took a look at muscle fiber physiology as well, which is very interesting. So what I mean is there's generally two types of muscle fibers, fast-twitch and slow-twitch. And one of the things that is a hallmark of aging is a selective reduction in fast-twitch fibers.

00:34:05 And that's because it's difficult to activate them unless you're doing high-force activities. You're going to activate slow-twitch fibers doing almost any activity of daily living. And so they stay around. Fast-twitch fibers, unless you're doing something of high force or going, not be used. And they're not going to be kept around. And that's a problem because when you look at things like the need for leg strength through aging, the ability to catch yourself from a fall, these things are incredibly important.

00:34:30 If you don't have fast-twitch fibers, you don't have the speed to get your foot out in front of you on time, and you don't have the eccentric strength to stop the fall from happening. And so if you look across, again, the aging literature, they're very clear about the importance of maintaining strength and fast-twitch fibers over time. So we know that this is an important

distinction here overall. And people will often talk about, how much of that is genetically determined? Can I change my fiber type?

00:34:56 And the answer there is resoundingly yes. And can I change it with exercise? And the answer is, absolutely you can. And then the next question is, how much? So now, again, we're going to see an order of magnitude. In general, without going too far down an area that maybe we can save for later, each one of your muscles in your body has a different percentage of fast-twitch and slow-twitch, for example, your calf. If you look at your soleus, which is the smaller one that goes in the back, that's generally mostly slow-twitch,

00:35:27 typically 80% or so slow-twitch. The gastroc, which is the other one right next to it. So if you were to point your toe next to your face and that part that kind of flexes out in the middle pops out, that's your gastroc. That is almost the inverse. So it's generally 80% fast-twitch, maybe 20% slow-twitch. Generally, anything anti postural or postural, rather, anti gravity, spinal erectors, things that are meant to keep you up or moving all day, are going to be slow-twitch. And things like your hamstrings, which are for explosion,

00:35:54 are going to be fast-twitch. Well, we biopsied the quad in these individuals. And in that muscle, it's generally about 50/50, fast-twitch, slow-twitch, as a really broad number. Well, one of the things that we found was in the non-exerciser, it was almost textbook what you would predict. It was about 50% or so slow-twitch, a little bit of percentage of fast-twitch, and then about 20% or what are these called hybrid fibers, which are a hallmark of an activity. All right. Great. In the exerciser, it was about 95% slow-twitch.

00:36:28 And so it's extremely clear-- again, I don't know if maybe their set point was a little bit higher towards that, and the non-exerciser devolved down to his place or the other one, but it doesn't matter. I mean, you're going from 40% slow-twitch in one case to 95% slow-twitch in another case. It shows you that the limits of physiological adaptation are darn near boundless given enough exposure. In this case, 35 years of extremely consistent training, and his muscle morphology was completely different than his identical twin with the exact same DNA.

00:37:01 ANDREW HUBERMAN: Those are two beautiful examples of people doing endurance work for a number of years and what that gives them in terms of benefits and functionality. Has the opposite experiment been done or observed, where somebody's just weight lifted or just sprinted for a number of years? I don't know that there's a identical twin control. That's a little-- ANDY GALPIN: No. I wish we had a third twin. ANDREW HUBERMAN: --too much to ask for. Right, triplets. So triplets out there, if you're exercising in different ways

00:37:33 or people who have triplets, maybe you assign one kid to be a runner, one kid to be a weightlifter, and the other one to be sedentary. Please don't do experiments like that. But the expectation, as I understand it, would be that the person that sprints or that does heavy squats, explosive work, would then have more fast-twitch muscle fibers in their quad. And their non-exercising counterpart would have fewer. That would make sense. But what happens if you assess the endurance level in somebody who's just done strength training or just sprinted?

00:38:07 ANDY GALPIN: Yeah. So we don't have those data specifically. We're actually just starting to have studies come out on lifelong strength trainers. And there's actually a very good reason for this, which is a whole story we can get into, but the quick answer is, we don't have a lot of people who've been lifting weights for 30-plus years. We have a whole swath of people who've been doing endurance training for that long. ANDREW HUBERMAN: Is that because fewer people have been weight training or are the weight trainers all dead?

00:38:36 ANDY GALPIN: You've got to go back to 1953, 1954. You had two major things happen that changed the entire course of exercise physiology and exercise science and, really, exercise as we know it. It's important to understand the history of our field. A lot of the questions I get are based on false assumptions of what exercise can and can't do. As an example, questions like momentum. Should I use momentum or that's cheating, right? Or it doesn't work. It compromises my results. It's actually totally untrue.

00:39:06 There are excellent reasons when you should use momentum when you lift. There are reasons when you should not. It is sometimes very beneficial to go fast with the exercise repetitions. Sometimes very slow and controlled is better. Any question I get-- in fact, I'm very infamous for always responding with, "It depends." The reason I say it depends is it depends on the goal. When you're training for speed or power or muscular endurance, the answer to some of these very common question differs. What people fail to realize is they

00:39:36 think they're asking the right question because they don't understand this history, what's being planted in your brain subconsciously, is driving that question. And it's not necessarily the right one. So if we walk through that a little bit, you'll see what that field has led. Why you think certain things matter when they actually don't or maybe your assumptions are incorrect and then exactly what to do about them. ANDREW HUBERMAN: I'd like to take a brief break and acknowledge our sponsor, Athletic Greens.

00:40:02 Athletic Greens is a vitamin, mineral, probiotic, and adaptogen drink designed to help you meet all of your foundational nutritional needs. I've been taking Athletic Greens daily since 2012, so I'm delighted that they're a sponsor of this podcast. The reason I started taking Athletic Greens and the reason I still take Athletic Greens once or twice a day is that it helps me meet all of

my foundational nutritional needs. That is, it covers my vitamins, my minerals, and the probiotics are especially important to me.

00:40:28 Athletic Greens also contains adaptogens, which are critical for recovering from stress, from exercise, from work, or just general life. If you'd like to try Athletic Greens, you can go to athleticgreens.com/huberman to claim a special offer. They'll give you five free travel packs, and they'll give you a year supply of vitamin d3k2. Again, if you'd like to try Athletic Greens, go to athleticgreens.com/huberman to claim this special offer. ANDY GALPIN: So in 1953, 1954, you had Roger Bannister breaking the four-minute mile,

00:40:56 so subfour-minute mile. And then you also had Sir Edmund Hillary and then his sherpa, Norgay, summit Everest in the same, basically, two-year span. That exact same year after that was the formation of what's called the American College of Sports Medicine. Now, that is still around today. It is the preeminent group for this Exercise As Medicine. So if you're interested in things like exercise for obesity prevention, for cancer treatment, for things like that-- it's not really sports medicine. It's more for clinical exercise--

00:41:25 that's the place to go, American College of Sports Medicine. So we have this launching of both a ton of people wanting to start doing endurance exercise and start swimming and cycling and running. And then you have a launch of people coming off of the back of the Harvard Fatigue Lab. So the fatigue lab actually shut down in 1947. So you have these people interested in physical fitness, but nowhere to go. Well, all those people left the Harvard fatigue. lab and started their own labs at other places.

00:41:51 So you've launched the careers of people like Dave Costill and John Holloszy and some of these very famous exercise physiologists. And they start building laboratories. And we start, for the first time ever, studying the science of exercise. So years go by, and these people happen. The 1960s the 1970s is what we call the runner's boom. So people start-- in fact, if you look at the numbers of people who are doing marathons, it explodes through these two-decade spans because it's like, we could do these endurance feats.

00:42:22 Notice both those feats were endurance, running short term as well as going over there. No one has thought anything about strength training and here's why. In the late 1880s, there was a very famous physician named-- George Winship, I think was his name, who was a big proponent of strength training. Well, he died in the age of 50 something of a heart attack. And that terrified people of strength training for 70 years because they're like, whoa, whoa, whoa. That stuff will kill you because he was a doctor,

00:42:49 he was trying-- he was running around the country, doing these exhibitions and reporting it, and then he died. ANDREW HUBERMAN: It's sort of like Atkins-- ANDY GALPIN: 100%. ANDREW HUBERMAN: --dying. Although some people say he died of a heart attack. Other people said he fell through the ice into cold water. That's debated, but the fact that a heavy proponent of a given nutrition plan dies suddenly. ANDY GALPIN: Yep. ANDREW HUBERMAN: Not good for business. ANDY GALPIN: So now the little storm is brewing.

00:43:14 1940s-- and I'm going back a little bit, but bear with me for a second-- there's a guy named Peter Karpovich, and he's a scientist out of Springfield, the decorated physical education, PE, that's a legendary place, Springfield College. And he is anti strength training for a lot of the same reasons. In his entire career, he talked about, don't do this. He's the one that launched these ideas that strength training will make you lose flexibility, it will be bad for kids, all these things that we know now are clearly not true.

00:43:43 He's a proponent of these things. And there is a show that happened at Springfield College, and a guy named Bob York-- and if you-- York Barbell, that's still around today-- is going around the country and putting on these exhibitions. They come to Springfield, and it's sort of like a new-age social media thing, where it's like, the students know what's about to happen because Karpovich shows up to this event. And everyone knows he hates strength training. And everyone is like waiting for it to end, just

00:44:13 to see what he's going to say. So this whole exhibition goes on, and these people are doing-- you've got to remember back at the time, bodybuilding, weightlifting, power lifting, strength, strongman, it's all the same thing. There's no differentiation yet. And it finishes, and Karpovich stands up, and the crowd goes silent. And he just asks one question. And he just points to one of the guys and says, scratch your back. And now he's just assuming and waiting for the guy to be like, ah and not be able to put

00:44:36 his hand behind his head. And I think he pointed to John Grimek, who's a famous bodybuilder. And he reached back and scratched his back, no problem. And then they proceeded to grab two dumbbells-- I think they were 50-pounds dumbbells-- and do a backflip, standing backflip with both in each hand. They started doing the splits on stage, and they start performing all kinds of physical function tests. And Karpovich is stunned. He's like, holy-- he has nothing to say. He leaves there, and his whole life has changed.

00:45:01 All these things he was claiming were shown, in his face, to be false. He does a 180 on his career. He starts running study after study on strength training and starts finding immediately there are no detriments to strength training in terms of global health. Of course, you can do it wrong and things like that. And in fact, here comes a whole bunch of benefits. So through the 1950s, while

this thing is going on with the endurance folks, no one's still strength training because there's no record to see.

00:45:29 There's no American College of Sports Medicine. There's no societies. There's no science. We're not sure it's safe. And meanwhile, Karpovich is just hammering study after study after study showing you it's safe, it's safe, is safe, but it hasn't picked up yet. And then everything changed in 1977. Thank you, Arnold Schwarzenegger. He came out with the trifold. He hits you with pumping iron, which I know you know that movie, right? Pumping Iron. ANDREW HUBERMAN: It's an interesting movie. Even for those not interested in bodybuilding,

00:45:54 it's a very interesting movie because it really gives a window into not just him, but the way in which weight training started to show up as a regular practice. When I was growing up, the only people who weight trained were people preparing for football, bodybuilders, who basically didn't exist in the town where I grew up. And the only people who did yoga were yogis doing Bikram, but now you drive through any major American city or European city and there is yoga studios, there's gyms with free weights.

00:46:25 ANDY GALPIN: Yup. ANDREW HUBERMAN: Arnold Schwarzenegger is largely responsible, I think, for initiating that shift. ANDY GALPIN: Yup. Because think about it. He hit us with Pumping Iron, Conan, and then The Terminator, almost in back-to-back-- very close, within years. So you've got this whole cascade of the '70s of people running, cycling, and swimming. Now, science is starting to come out that it's not dangerous and maybe, actually, some benefit. And then boom. Not only is it not bad for you, it

00:46:54 can make you into a real world superhero. I mean, think about the psychology of a child growing up, watching somebody like Conan. Think about what Batman looked like in the 1950s and '60s. And then boom. I can look like that? Now, not everyone wants to look like Arnold, but you see the power that can land in people. No one had ever seen or thought you can make your body transform like that. You could maybe be born like that, but no chance. That's within the grasp of all of you. ANDREW HUBERMAN: When I was a kid growing up,

00:47:24 one of my favorite books was The Guinness Book of World Records. ANDY GALPIN: Yeah. ANDREW HUBERMAN: I still have images in my mind of the coldest animal. ANDY GALPIN: Yeah, sure. ANDREW HUBERMAN: The longest lifespan, et cetera. And there was a picture in there of Arnold Schwarzenegger. And you know what his record was? It said, perfectly developed man. ANDY GALPIN: Yeah, yeah, yeah. ANDREW HUBERMAN: Which is, as you point out, that isn't the physique that most people aspire to. ANDY GALPIN: It doesn't matter, though.

00:47:48 ANDREW HUBERMAN: But it did inspire this shift. The other thing about resistance training that I think has a certain allure for some people, men and women, is that it's one of the few forms of exercise that because of the enhanced blood flow to the muscle that occurs during the training, the so-called "pump," it gives you a transient but somewhat real window into what your results will be. ANDY GALPIN: 100% ANDREW HUBERMAN: When you run and you're gasping for air, you aren't experiencing what it's

00:48:16 like to be faster than you are that day. ANDY GALPIN: That's correct. ANDREW HUBERMAN: But when you weight train, you get an aesthetic picture into how your functionality and aesthetic will change. It disappears a few hours later-- ANDY GALPIN: Sure. ANDREW HUBERMAN: --as the so-called "pump" subsides, but it's a very interesting form of exercise in that way. It's almost as if you go in to learn a language and during the process of learning, for brief moments, you're actually fluent, and then it gets taken away.

00:48:38 ANDY GALPIN: Yeah. ANDREW HUBERMAN: So it puts the dopamine carrot out in front of you. ANDY GALPIN: Yeah. ANDREW HUBERMAN: This is just me hypothesizing as to why weight training might have taken off the way that it did. ANDY GALPIN: Yeah, I mean, it's like if you got paid every hour on the hour when you were working. And then at the end of the day, They take the money back, but you still-- as the time clock is going on in your day, you're looking up, and you're watching your bank account grow in real life.

00:48:57 You can see why it's so addicting to those folks. So to finish the story here, going back to your actual question answer. This is happening in the late '70s, early '80s. And so now Joe Wieder, all these gyms, they're exploding because people want to look like that or they realize they have the chance to change how they physically look. That had never been a reality before. ANDREW HUBERMAN: Mostly men at that point, I'm guessing. ANDY GALPIN: Almost exclusively, yeah, for a large number of reasons, cultural acceptance, et cetera.

00:49:26 Even with endurance stuff, you could get fitter and run faster and that's better, but it wasn't going to change how you looked unless you were losing fat. Now you can change how you look, which is so incredibly addicting. In fact, there's a very famous quote. I think it was actually Joe Wieder who said, "Show me one man who wants to be strong, and I'll show you 10 who want to look strong." It's like, that's very, very powerful. There's this a whole-- there's tons of this history I can go into, which is sort of explaining to you.

00:49:52 But now you know you're in the mid- '80s, and you have what I call my generation. So you have my generation, who fall in love with strength training in the 1980s and '90s, but there's really no scientific field for it. It's not really come about yet. The science of endurance and exercise physiology is now humming along at a massive rate because these people came up in the '70s and

'80s, and they're five, 10, 15 years in their career. They're producing. They're generating graduate students. They're starting their own labs.

00:50:20 And they exercise physiology, still to this day, is 80% endurance, steady state stuff almost exclusively. Well, now my generation, you love sports. You love lifting. You love all these things. And now what we see happen is the Chicago Bulls, Michael Jordan starts picking up strength training. Ooh. That's on TV. He's on SportsCenter in the mid 1990s, lifting weights. And we go back, actually, to the late 1970s. And I'm not sure if you're a football fan, but any football fan will recognize the Nebraska

00:50:48 Cornhuskers in the 1970s and '80s changed how football's played. Well, the reason is because they started strength training. And they started doing it with a guy named Boyd Epley, who was the founder of the NFCA. So the National Strength Conditioning Association is formed in the late 1970s as well. So just like ASCM was developed the year after those two events happened, 1978, the year after Arnold comes out, boom, NFCA is formed. And now you have a scientific organization dedicated to strength and conditioning.

00:51:17 You've got NFL strength conditioning coaches that are starting to come on board. You've got scientists that are starting to come into labs. And strength conditioning becomes a scientific field. Well, everything swings now, from an exercise perspective, into bodybuilding. And so almost all of the things-- in fact, we were sort of talking before, I could run a whole bunch of tricks on you. And I could ask you a whole bunch of questions about things that you think are absolute standards or guarantees about training.

00:51:43 I'm supposed to do this. I'm never supposed to do that. ANDREW HUBERMAN: For instance? ANDY GALPIN: For instance, is it OK to train a muscle group on back-to-back days? Most people are at home thinking, no, you're not supposed to train a muscle-- ANDREW HUBERMAN: It needs to recover. ANDY GALPIN: And that's total nonsense. Other things like body part split training, training one muscle group per day, other things like cardio, endurance training influencing, will it ruin my gains for my lift? All of these things are on at a base of assumptions

00:52:15 that come from bodybuilding. Now, that's a fantastic world, but because everything started in the late 1970s as bodybuilding, in terms of-- basically strength training was that. Weightlifting and powerlifting were not at all around. They were, but nobody cared. Again, show me someone who wants to be strong. I'll show you 10 who want to look strong. The physique thing just dominated, and we're not getting out of that yet. We're not all the way out of it. We're starting to, though, because here's why.

00:52:40 People started to realize, this bodybuilding thing is fantastic. I can change my physique. I'm getting better, but damn, these workouts take an hour and a half, two hours. And I'm going to spend that whole time on one or two body parts, which means I'm going to have to lift six days a week, and I'm going to have to do that consistently. Now all of a sudden, boom. Two hours on my elbow flexors. Damn, my elbow's starting to hurt. ANDREW HUBERMAN: And yet, my understanding is that it doesn't really require two hours a day--

00:53:10 ANDY GALPIN: Not at all. ANDREW HUBERMAN: --of training in order to get benefits, even just for hypertrophy. ANDY GALPIN: Totally. But a lot of the times, you're going to have to get some amount of time in because you're spending so much isolation. So we've gone away from training movement, running as a movement, cycling as a movement, training my biceps as a muscle or muscle group, training my hamstrings or a muscle group. That's not a human movement. So we've done a 180 in terms of selecting the exercises

00:53:36 from movement-based prescription to now muscle group-based training. So when you're isolating muscle groups, that means a whole chunk of your body is really not doing much throughout the day. So what happens if you're doing, say, legs on Monday and you miss Monday because you're on a flight? Now your legs have to wait a whole other week. So this starts to become problematic. People start getting beat up. People start realizing, I actually don't feel that great. I'm not super fit. I'm sweating just walking up the stairs.

00:54:07 I'm out of breath. Why? Because all that training, you've done nothing for your cardiovascular fitness. You've done nothing to improve heart rate, oxygenation, blood flow. And so that paradigm swung way too hard into the exercising, especially lifting weights, is single joint, often machine, often slow, often high-volume isolation stuff. And that left a giant opening of people going, well, wait a minute. What if you could get in the gym, I can promise you the same or better result in under 30 minutes?

00:54:38 And, in fact, you'll also feel better. You'll lose more weight. And that opened up group exercise classes, kettlebell stuff, CrossFit type of stuff, circuit training because you can come in, you won't get so beat up because the volume is lower, the time is much lower. You get multiple adaptations at the same time. Great. The problem with that, though, fast forward 10 years, is it started burying people because you've now de-emphasized movement quality, and you've overemphasized scores. So this is a classic example.

00:55:10 If you go and you watch Pumping Iron or any bodybuilder, you'll see if they're doing a bicep curl, they don't even really pay attention to the rep range. They don't really pay attention to the load. They are looking at their muscle. They're trying to figure out, how do I get that thing to fire? They're squeezing. They're flexing. They're posing at the end of every set. They're trying to figure out,

am I getting enough pumps? It is exclusively founded on exercise quality. The rep brains, the numbers, almost irrelevant.

00:55:34 When you go to the other model, exercise technique, it doesn't matter. Just get the most amount of weight up or the amount of reps or the fastest time, et cetera, et cetera. High-intensity. ANDREW HUBERMAN: This would be CrossFit. I've walked past some CrossFit. I've done two CrossFit classes. ANDY GALPIN: I don't want to get sued. So you said "CrossFit." I didn't. ANDREW HUBERMAN: Oh, no I enjoyed them. I definitely felt like I was working hard. ANDY GALPIN: Oh, you will. ANDREW HUBERMAN: I observed a lot of people

00:55:55 in very close proximity doing Olympic lifts and doing kipping-- that's where you kick your legs, folks, say, sort of like bucking and kipping type pull-ups. No. I enjoyed it. It wasn't for me for the long term, but it did seem that there was a lot of ballistic movement in close proximity to other people. So the hazard to me seemed more about that than the actual movement. ANDY GALPIN: Well, again, the point I'm setting up here is, that was actually a really brilliant solution for a lot of the problems the classic bodybuilding

00:56:27 hypertrophy introduced. So it got away from isolation movements and got people doing big movements, which are more effective, generally better. It got people doing things fast and explosive. That's more athletic. That is more important for longevity. It solved a lot of the problems. Joint health wasn't getting crashed. The issue they went with is they just pushed the pace on score rather than quality. They pushed the pace on how many people can be in here at the same time. So now you're doing higher-risk movements, higher intensity,

00:56:56 higher fatigue, and with a total-- not that they don't care about technique, but it's not the thing that they're most concerned about. It's getting the number and the thing done. They solved the time issue, though. You can get tremendous results in three days a week, under 45 minutes each session, et cetera. Burn people out, though. Way too much high intensity, way too often. And the other problem, safety concerns, all kinds of orthopedic issues and other stuff. ANDREW HUBERMAN: Can I interrupt you for a moment

00:57:23 and just ask a question, as we go through this arc of the history of why endurance training predominated or strength training or bodybuilding type training or CrossFit type training because I think this is fascinating, and I know we're about to arrive at where we are today-- ANDY GALPIN: Yeah. ANDREW HUBERMAN: --and what the future looks like for people and what they should focus on and do. At what point, if any, do you think resistance training started to become adopted by women? There was no equivalent of Arnold Schwarzenegger

00:57:54 there was Linda Hamilton in The Terminator. ANDY GALPIN: Yeah. ANDREW HUBERMAN: There are some impressive physiques, certainly, on female actresses and athletes. The Williams sisters, very impressive musculature and physiques. And, of course, their tennis playing speaks for itself. Has that happened yet? What I mean is, do you think, since you work with both men and women, do you think that most women understand that weight training, done properly is going to be extremely beneficial for them, maybe even

00:58:29 especially for them, in terms of offsetting bone density loss and things of that sort? Or are we still waiting for the popular stimulus for getting 80% of young women thinking, I want to lift weights? ANDY GALPIN: Yeah. Hard for me to answer because I'm not a woman. Now, I have a daughter. She's four, so we'll see. What I can say is, I've probably worked with-- I don't know how many professional athletes in total. A lot. I've worked with them probably 14 professional sports. I've worked with Cy Young winners,

00:59:04 MVPs, all the credentials. I bet 35%, 40% of the athletes I've worked with are female. So I've worked with Olympic gold medalists. I've worked with bronze medallists in multiple sports. I've worked with the most decorated powerlifter of all time in a number of these areas, fighters, world championship, all of these things. For me, I feel like that burst has already happened. My students, if you look at my classroom, I don't know what the numbers are, but there is no small number of females in exercise

00:59:35 science and excess physiology. If you look at our laboratories, that's one thing you will see. There are very few female exercise scientists. There are very few female strength conditioning coaches, but that number is coming down at an astronomical rate. You have people that are being hired in every sport. You pick the NFL. You pick Major League Baseball. Every few months we're hearing, first female hired for this, first female hired for that. The Yankees, Rachel Balkovec is fantastic. ANDREW HUBERMAN: Yeah, Rachel's been out to my lab.

01:00:08 She's terrific. ANDY GALPIN: Yeah. Oh, yeah. She's fantastic. I mean, she's now being hired as the-- I think she's a hitting coach now, actual sport coach. She's going to be a GM. This is her goal. She's a terminator. So that's already happening. And my students that are coming through our program are getting placed in these roles. They haven't gotten through yet a lot in terms of being an actual scientist, but they're getting there. Sports scientists in the NBA are being hired, females, in terms of big data collection.

01:00:33 And sports science and tech, we'll cover in another discussion, but I think it's happening. Whether or not the cultural and social-- I can't speak to that end of the equation. What I can speak to, though, is one of the things I think is most fun coming forward scientifically is a number of years ago, NIH came through with their mandates. They're saying, it's no longer

acceptable to exclude women from scientific research because we just did that for decades.

ANDREW HUBERMAN: Well, what happened-- just

01:01:05 to fill this in because I think it's worth noting is that for many years, studies even on rodents were mainly carried out on male rodents because the assumption-- and the assumption turned out to be wrong-- but the assumption was that the physiology of female rodents-- because they don't have a menstrual cycle. It's not 28 days. They have an estrus cycle. It's four days, a different type of cycle-- that would somehow disrupt the data. It turns out that's entirely wrong. Now it's actually required.

01:01:34 When you sit on a grant study panel, which are the people who evaluate grants, they ask. They literally say, did they meet the criteria for sex as a biological variable? Here we're not talking about sex as the verb. We're talking about sex as biological sex. And if you don't say yes, that's a strong hit against the grant. And if you say yes, then it checks off that box. So it's now required that both male and female rodents and humans be studied in a given study unless the study is specifically geared toward understanding

01:02:01 that only exists in one or the other population-- ANDY GALPIN: Reproductive study, things like that. ANDREW HUBERMAN: --such as menopause, for instance, ANDY GALPIN: Yup, totally. ANDREW HUBERMAN: --menstrual cycle, andropause, for instance. But no, this is extremely important. I'm excited to hear that. ANDY GALPIN: So where I was going to go with that is actually, so that was step one, which is cool. You've got to include them. Where we haven't gotten to yet, but I've seen more and more grant applications come through for this,

01:02:23 it's just the funding hasn't it yet, which is, it's one thing to let women be in the same studies. That's great. It's another thing, though, to start performing high-performance research specifically for female questions. That has not happened yet. And that's just a funding issue. We haven't gotten money yet. People aren't supporting that. We don't get a lot of financial support for sports science, but we can't track down the money yet of me going, I want to do a study in female athletes that answers female athlete questions.

01:02:50 These won't help men. These are questions specific to the female. That's the next step. That's where we've got to get to so we can say, maybe we should do things differently around training or recovery or we shouldn't or it doesn't matter. There's a handful of-- not lower-quality, but some studies. I don't love them yet. There just needs to be a ton of work. Birth control is a very good example the information for women at female athletes or even just hard exercisers-- you don't have to be a competitive athlete--

01:03:22 around what is birth control doing? What types? How should I manage that? What conversations should I be having with my doctor? Almost nothing. Women have nothing to go on for high-performance stuff. So what if I'm trying to compete in an event or run a race? All those types of questions should be answered. Normative value, normative data, performance testing. It's just not there on the female. So that's an area. I think-- if somebody really wanted to make a change, the scientists want to do it.

01:03:50 I know it. I've talked to so many in our field that would really love to explore it because it's getting there. Like I said, the coaching side is getting there. They're seeing it. They're hiring these people. I'm seeing it in my students. My followings is not all men. It's a very large percentage of females, and all I do is post about exercise science. This is all I do. ANDREW HUBERMAN: Well, this podcast is very-- we know very clearly the audience is 50% women, 50% men-- ANDY GALPIN: That's nice.

01:04:18 ANDREW HUBERMAN: --which is great. ANDY GALPIN: So just to jump back in our history discussion and to finish that point of where we're at now and where I think we're going to go or should go. So we walked through the bodybuilding running everything and people walking into a gym. Any time they lift weights, they're making all of their choices based on the assumption that maximizing muscle size is the goal. And clearly, that's not the case. There are other adaptations you may be after. So we talked about how that had problems,

01:04:46 and then we talked about how some of these other forms of exercise filled those gaps and then what problems those things introduced. Well, I think we're actually at a point where that pendulum is slowly shifting into the middle. What I mean by that is, if you want to maximize muscle strength, we look towards the power lifting community. If you want to maximize muscle power, we're going to look to the weightlifting community. If you want to look for muscular endurance, well-roundedness, maybe we look into the CrossFit communities

01:05:11 and some of these obstacle course races or functionality things. So what we can do now is generate protocols that get us the exact adaptations we want and not ones we don't want, because we can look back at each of these different styles of training and pick and choose optimal protocols or combinations for them. So if somebody simply wants to get healthy, like we talked about when we listed the nine adaptations and I mentioned health wasn't one of them, that's because what determines your health

01:05:40 versus what determines my optimal health differs. So if I need more hypertrophy, I can look towards bodybuilding concepts, but if I have enough or maybe for personal reasons, I decide I have too much or I don't want to add any more, then I can say, hey, how can I get stronger without getting bigger? And boom, I look towards powerlifting concepts. How can I get more

powerful? How can I get faster but I don't, again, want to lose fat? OK, great. Or if I want physique changes. So we have all these different areas

01:06:07 we can pick and choose from that have expertise in specific adaptations and develop ourselves perfect protocols based on that information. ANDREW HUBERMAN: I'd like to take a brief break to acknowledge our sponsor, InsideTracker. InsideTracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals. I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact

01:06:34 your immediate and long-term health and well-being can only be analyzed from a quality blood test. One issue with a lot of blood tests and DNA tests out there, however, is that you get information back about various levels of lipids and hormones and metabolic factors, et cetera, but you don't know what to do with that information. InsideTracker makes knowing what to do with all that information exceedingly easy. They have a personalized platform that lets you see what your specific numbers are, of course,

01:06:57 but then also what sorts of behavioral do's and don'ts, what sorts of nutritional changes, what sorts of supplementation would allow you to bring those levels into the ranges that are optimal for you. If you'd like to try InsideTracker, you can visit insidetracker.com/huberman to get 20% off any of InsideTracker's plans. Again, that's insidetracker.com/huberman to get 20% off. So with the understanding in mind as to how we all, myself included, arrived at such lopsided fitness, too much endurance, not enough strength, too much strength,

01:07:28 not enough endurance, it's really hard to imagine that anyone's perfect in this regard. Can you walk us through the nine different adaptations that you mentioned earlier and give us a way to assess our level of ability or our level of adaptation in each of those nine? ANDY GALPIN: All right. The very first one we want to talk about is movement skill. Now, set aside sport specific. So I'm not going to give you an assessment for optimal golf technique swing. This is really about human movement so that you stay injury free and you

01:08:01 can continue to train for as long as possible. So what are the minimum requirements? Now, if you can have access to a highly-qualified physical therapist or movement specialist, that's the best route. Go to them. Have them identify all of your movement patterns, overhead pressing, squatting, running, all these things. That's your gold standard. If you want to do it yourself, though, here is a very simple four-step solution. So the way that I teach this is I go joint by joint. And so I think of this as the major ones, your shoulder,

01:08:32 your elbow, your low back, hip, knee, and ankle. Now, what you can do is do a representative movement for you. So if you bench a lot, use the bench. If you do pull-ups, use the pull-up. If you squat, do that. I would recommend doing an upper-body press, an upper-body pull, a lower-body press, a lower-body pull. An example would be a push-up, a pull-up, or a bent row, a squat, and then a deadlift. That would be a very, very well-rounded approach. What you're going to do is do that movement. And I would record it for yourself.

01:09:06 And record a frontal view and a side view. Probably do three to 10 repetitions per angle, slow and controlled. You don't need any body weight. What you want to do is move, and you want to look for key things at every joint. So again, imagine I'm doing a squat. I'm going to do a squat, and I'm going to focus on just my ankle. And I'm going to look for these four things of the ankle. And then I'm going to go back and watch my knee and look for these same four things of the knee through the hip, et cetera.

01:09:35 So what are these four things? Number one is you want to look for symmetry. So symmetry is front to back, left to right, and your right limb and your left limb. And so what we want to look for are if they aren't moving perfectly, that's fine. But you want to see is one moving further ahead than the other one? Is one turning to the side and one's not? Is one fidgeting and twitching around differently? So you want to look just to check, to see and make sure that they're stable. That's one. Number two, you want to look for stability.

01:10:06 So a key indicators here are things if you can't get through Squat, a controlled squat, where your knees don't start shaking. That would be an instability issue. So can you do the movement slow? Can you pause at the bottom, maybe three seconds, maybe five seconds or 10? You should have complete control of that movement and all of these joints. Are your hips sliding to one side when you stand up? Is one elbow closer to your body when you're benching and the other one's more flared out? These are the things I'm talking about.

01:10:36 I'm not worried about what angle they should be at or not. You're simply looking for asymmetries or instabilities. So again, as you're pushing up, does one elbow start flipping and twitching and going all over the place? The third one is what I call awareness. So there are a lot of movement technique issues that, simply, people don't know. And so you'll watch them squat. I do this in my classes all the time. I'll have 100 kids out there, squatting. And you'll see some horrible squat technique. And then when you just tell them, hey,

01:11:03 did you realize your heels are supposed to be on the ground all times when you squat? They're like, oh, OK. And they can correct it. It's not actually a movement flaw. It was just simply an awareness. I didn't know, and then I actually didn't realize that was happening that position. So we want all of our joints to be going through a general full range of motion, which is

number four. So the ankle-- during a squat, your knees should be able to go as far over your toe as possible while maintaining good position, your feet

01:11:27 flat on the floor, your three points of contact, your whole flat foot, and you're not compromising another joint. So that's all you're going to look for are those four things, symmetry, stability, awareness, and range of motion through each joint, through each movement. It sounds difficult and time-consuming. It's really not. You can generally clear these things in one or two repetitions in a couple of seconds. And what you're really going to look for-- there's lots of scoring schemes you can test, that physical therapists

01:11:57 will sort of do. I just look for absolutely terrible, can't do it at all, minor flaw, or pretty close to good. That's really all I'm looking for. So my scoring system is zero, one, three. Zero is like, you're not going to do this exercise because you're at a very high acute risk. You might get hurt on rep one tomorrow. Number one, a score of one is like, there's a minor flaw here. We can probably do it, but we need to be cautious of load and volume. And the other one is, maybe it's perfect, maybe it's not, but go ahead and it on a reasonable protocol.

01:12:29 You'll be fine. So that's generally what you would need to do as a cost-free method of identifying good movement technique within any of the things that you would do. ANDREW HUBERMAN: What about speed? ANDY GALPIN: I actually don't think this is one most people should test. If you're a high-performance athlete, we can run a 40-yard dash or we can do some different things with a velocity transducer on a barbell, if you're a weightlifter or something. For most people, pure speed is really maximum velocity or acceleration are

01:12:58 the two ways we break it down. It's generally not that necessary to test. ANDREW HUBERMAN: What about number three, power, which I believe before you told me was speed times force. ANDY GALPIN: So the reason why I don't worry too much about speed is because you can infer a lot of it from a power test. And a power test is easier to do as well as easier to train for for most people. So the cost-free version here is a simple broad jump. So this is stand with normal position, jump out as far in front of you as you possibly can,

01:13:28 and measure the distance between where you started and the back of your heel, where it lands. A super basic number to look for there is your height. So you should be able to broad jump how tall you are. If you're 5' 5," you should hit 5' 5," 6' 5," et cetera. It's not perfect. That's going to ratchet down a little bit, about 15%, for females. They just simply don't have the power, in general, that men have. And so you're going to want to bring that down a little bit, but it's a very crude number.

01:13:55 If you were to look at a high-performance NFL player, if they're six feet tall, they're going to be jumping nine to 10 to 11 feet. If you can jump your body height-- we're not looking for optimization in this particular test. You are looking for red flags if you can jump your body height, you're going to be just fine. ANDREW HUBERMAN: That's incredibly straightforward and yet, I have one question. ANDY GALPIN: Yeah. ANDREW HUBERMAN: I'm assuming that I can squat down as low as I need to before I jump,

01:14:21 I can swing my arms from back to front as harder, with as much momentum as I can muster. And when I land, you said I'm going to take the measure from where the back of my heels. ANDY GALPIN: You want to measure the distance you actually covered. So to clarify, there's no running approach here. There's no steps into it. You're going to stand at a still. Yeah, you can swing, bounce as much as you'd like to do. You're going to projectile off. So you're going to measure the distance from the tip of your toe-- so basically, stand

01:14:48 behind the line and then the furthest point back where you land. So basically, the worst possible score, not the best possible because your feet won't land symmetrically. One's probably going to be a little bit farther. Now, technically, if you fall backwards and your hand touches the ground, we mark that number, but in this case, just use the furthest point back over your back heel, and go from there. ANDREW HUBERMAN: I'll be trying it tomorrow morning. ANDY GALPIN: Now, if you have access to a little bit more technology or you just really want

01:15:16 to know a better number, a classic vertical jump is a good starting place. So you can actually do this in a simple, cost-free way. You can just measure two of your hands. Put them together so that both of your middle fingers are touching. Overlap them, and put them directly over your head. And then you want to reach up as high as you can get. And you mark that on the wall. My brother and I used to do this all the time. We would take a highlighter, the yellow ones, and color as much as we could on our fingertips,

01:15:43 touch the wall so that the highlighter would stain the wall-- if you actually go back to my house from my childhood, you'll see these markers all over our house. ANDREW HUBERMAN: I'm sure your parents were thrilled. ANDY GALPIN: My dad didn't care. Single dad, he didn't care. He's just like, whatever, you guys. Do whatever you want. So you want to measure that. And then, of course, you're going to jump with those two hands and touch as high as you can up. And you're going to measure the distance between your standing

01:16:05 reach and the actual height that you jumped there. Now, the reason you're doing it two-handed by the way, is because if you do one-handed, you can actually reach pretty high by offsetting your shoulders. And now you're getting into differences of who has more shoulder mobility, who has the ability to get up there. A two-handed standard approach is there. Same thing,

no running approach here. You can dip. You can drive. You can do all those things. You can swing your arms, but you're going to be a two-handed touch, is a general way to do that.

01:16:33 You want to look for a number of something like 24 inches or higher. If you're past the age of 50, that number can come down a little bit, to closer to 20. And again, for females, it's going to be ratcheted down about 15% everywhere you go. If you're a middle-aged female, and you're jumping 20 inches, you're in a pretty good spot. You're going to be looking really nice there. Now, if you can do that on a force plate, that's even better. So these are, basically, scales that will go out to multiple digits, sometimes five to nine digits

01:17:06 past zero. And you're going to stand on these things, you're going to do the exact same test. And these are very interesting because they'll tell you not only how high you jump, but they'll tell you how much force you put in the ground. They can also tell you how long it took you-- and this is called your rate of force development-- as well as impulse and speed and a bunch of other stuff, which are important to help you understand where on the power spectrum you need to be. So you would do that in addition to using some sort of velocity

01:17:32 transducer on a barbell. So a very classic thing to do would be, let's say, you're going to do a squat. And you're going to put this device on the barbell, and that's going to measure the speed at which the barbell moves. And you're going to do that at 40% of your one repetition max, 50%, 60%, 70%, 80%, 90%, up to 100%. And that allows you to create what's called a force-velocity curve. And you can start to see at what point, when you start loading things heavy, do you start slowing down too much.

01:17:59 And that will tell you what part of the force-velocity curve that you want to train in to optimize your power. Why that's important, a lot of people will do things like, when I'm training for power, how heavy should I lift? Well, the general answer people say is, 30% of your one-rep max, but that's actually not true at all. What's most optimal for power development-- which we'll discuss more much later-- is depending on where you're flawed in the force-velocity curve. So if you have access to technology like that,

01:18:25 that can give you a lot more insight and information. If not, do the broad jump test or the highlighter on your fingertips and jump it up and touch the wall test. ANDREW HUBERMAN: At Andy Galpin's house. ANDY GALPIN: Hey, just come along. The walls are already messed up. Just go ahead and come up to Washington, and we'll do it. ANDREW HUBERMAN: Fantastic. What about strength? ANDY GALPIN: Right. So strength is really important. You need to measure this in multiple areas. And we'll start off with grip strength.

01:18:50 So you can do this in two ways. You can buy a hand grip dynamometer. Now, these are anywhere between \$20 to \$100, anywhere. These actually used to be, when I was in school, hundreds of dollars. And now you can literally buy them on any website for \$25. So my honest recommendation is technically, that's not cost-free. I know your whole thing about the cost-free protocols, but \$25, I'm calling that basically cost-free. You can bring that in and test that. And that's just a little device where you're going to squeeze,

01:19:17 and you're going to do it. And I would do your right hand and your left hand. You want to look for asymmetries there, but you want to look for something like-- typically, they're going to give you a value in kilograms. And you want to look for something like a minimum score here of 40 kilograms. Ideally, you're up past 60 would be a really good spot to be in. You want to make sure that there's no less than 10% variation between your left and right hand. Your non-dominant hand actually shouldn't be

01:19:42 that much weaker in this test. So what you'll actually see, a lot of times, is the non-dominant can be oftentimes stronger because the dominant hand is more for movement precision, writing, things like that. So you want them to be close. If you are a male and you are under 40 kilograms on a hand grip dynamometer, we're going to need to train that. If you're a female, it's not that much lower, but about 35 kilograms is the cutoff point. If you're above 55, we can add it to your training, but I'm not worried about leaving it out

01:20:13 of your training. If you're a female, if it's above 50, that's my cut off of where we want to go. So that's a fairly cheap one. Another one that you can actually do is just a dead hang. So you can hold on to any bar, ideally, one that is thin enough to where you can wrap your whole hand around it. So you don't want to be using a giant fat grip. You're going to have a false reading here. So something like going to the gym and jumping on any pull-up bar or pull-up rack. And you want to hang, and this is a simple time test.

01:20:41 So in general, we should be able to hang for a minimum of 30 seconds is what we're looking for. 30 to 50 seconds is my goal, but we could probably get better here. If you're cruising above 60 seconds, I'm generally pretty happy. This is actually a good example of when females tend to be better. Grip strength on women tends to be strong, and they can hang for quite a long time. So those standards don't really change that much for women. Now, if you are exceptionally large, this thing doesn't scale perfectly.

01:21:14 If you're 240 pounds and even if you're lean, it's just hard to hang and hold 240 pounds. Conversely, if you're 145 pounds, even if you're unhealthy, you're going to be able to hang for a long time. It's just not that much weight to carry. So just rough numbers to start off with.
ANDREW HUBERMAN: So that's grip strength. What about strength elsewhere in the body? ANDY

GALPIN: The primary ones, you can do an upper body strength test if you would like, although it's not technically something we do very often.

01:21:41 I'm happy to do it one at max bench press or something like that. That's great. What I'm generally more interested in is a leg extension test. And the reason I like this is, a back squat is better. A barbell back squat is-- look, that's my jam. That's my life. It's just very technically demanding, and it's challenging. You need spotters. You need comfort. A lot goes into this. So for the average person, a leg extension test is fairly standardized. You don't have to worry about technique, and people can just get into it and go.

01:22:11 And so what you want to look for there is a couple of standards you want to hit. Again, a very simple answer here is body weight. Can you do a leg extension with your body weight? ANDREW HUBERMAN: One repetition? ANDY GALPIN: One repetition. ANDREW HUBERMAN: I can answer that right now. ANDY GALPIN: Can you? ANDREW HUBERMAN: No. ANDY GALPIN: You can't? ANDREW HUBERMAN: No. I can hack squat a reasonable amount of weight, but I was on the leg extension this morning, and it was a Nautilus machine.

01:22:35 And I certainly could not leg extension my body weight. ANDY GALPIN: Let me clarify. Were you doing a single leg? ANDREW HUBERMAN: No. ANDY GALPIN: So bilateral, you can't leg extension your body weight? ANDREW HUBERMAN: No. But I certainly can hamstring curl my body weight. ANDY GALPIN: OK. So we maybe have some deficiencies in our quads that we need to go after, but that's a pretty good number you want to be at. If you go up in age past age 40, every decade that can come down about 10%, and you'll still

01:23:00 be in a pretty good slot. So if you're 50 years old and you're 170 pounds, if you can do 160, you're in a pretty good spot. And then you could just, again, take it down about 10% every decade after 40, but prior to 40, there's really no change in strength, but certainly, somebody in their 40s to 50s should be able to leg extension their body weight. ANDREW HUBERMAN: Noted. I look forward to our discussion a bit later, talking about how to build strength. ANDY GALPIN: Yeah. Any of these strength tests, they

01:23:30 don't have to be done to a technical true one-rep max. You can use what are called repetition conversion equation. So put on a load that you think is kind of close to your maximum and just do it for as many reps as you can. As long as it's under five reps total, you can then actually go online and enter that into any number of calculators anywhere, and it will tell you, OK, you did three repetitions at 200 pounds. Your one-rep max is probably 215, whatever. So there's estimate equation. So if you don't want to spend the time

01:24:00 or you're not truly comfortable absolutely going to your true one-rep max, just get to a number that's fairly close and do as many as you can and then go on line, again, one-rep max estimator equations are everywhere. If you get past five repetitions or so, the accuracy of those equations starts going down. So don't put on something and go, oh, I did 12 reps of it and then try to figure out your one-rep max. It'll get close. You start moving past that, you're just getting worse and worse and worse accuracy.

01:24:27 So I want to make sure whether you're doing the leg extension test or a front squat test, you don't technically have to do it in absolute one-rep max. If neither of those are an option, another one I like a lot here is simply a front squat or a goblet squat hold. So you're going to hold a weight in front of your chest. A kettlebell is great here. A dumbbell is fine here. And you want to hold about half of your body weight, go all the way to the bottom position, and try to hold that for about 45 seconds.

01:24:56 So it's a pretty good indicator of number one, your position. It's hard to be in a bad position for that long at that load as well as core strength and low back stability. So it's a very different indicator than, say, the leg extension test, but it's a really nice one. It doesn't require many moving parts. It's more difficult than the leg extension, but it's quite a bit more functional. And it's going to give you insights into a lot more areas than just the quadriceps. ANDREW HUBERMAN: So 45 seconds down at the bottom of the squat

01:25:23 and then returning to a standing position. ANDY GALPIN: Yep. And if you can't do the return, actually, I'm not that worried, but as long as you can hold that good position without a technical breakdown in that 45 seconds, that's a really good spot. As an intro, I want a third of your body weight for 30 seconds. ANDREW HUBERMAN: Terrific. I plan to attempt all of those strength tests very soon. What about hypertrophy? ANDY GALPIN: Sure. Actually, before we get into that, I want to jump back really quickly.

01:25:50 It's important to add a couple of caveats to the strength training stuff. So there's two that I want to do. Number one, these are assuming you are technically proficient. So I don't want you to do any exercise to exhaustion or to maximum strength if you're not comfortable with your technique. So adjust these accordingly. If you're not comfortable with the front squat, do the leg extension. If you're uncomfortable with that, do something different. So we never want to utilize maximum testing if it's going to come with a consequence

01:26:19 of serious acute injury. So that's the most important flag. The second one is, your warm-up protocol will have a huge effect on your actual results. And so whenever you do these tests, especially if you're going to do a test and then a test again down the line, you want to make sure that warm-up protocol is standardized. Now, again, the NFCA-- and I can give you resources--

has specific guides for exactly what to do for your warm-up protocol prior to one-rep max testing. So we can go there, and you can look that stuff up.

01:26:49 We can add that to show notes or something. ANDREW HUBERMAN: Yeah. And I think when we get into a deeper discussion about strength and hypertrophy and resistance training in general, maybe we could touch into the best warm-up protocol. I know I have mine, and I'm certain it's going to be suboptimal based on everything-- ANDY GALPIN: Maybe that's causing the problems. ANDREW HUBERMAN: --based on every conversation we've ever had, where I learned all the things I'm doing incorrectly. But I do make changes on the basis of what you tell me.

01:27:10 ANDY GALPIN: It's not incorrectly so much as it is suboptimal. ANDREW HUBERMAN: That's a very kind way of telling me it's incorrect. Thank you. What about hypertrophy? ANDY GALPIN: So the thing you want to pay attention to here is, you have the aesthetic portion of hypertrophy. That's entirely up to you. There is no rationale. You can decide what you feel like looks good or doesn't look good. That's irrelevant. There is a sufficient amount you need to have, where below that, it's detrimental to your health,

01:27:37 regardless of your outcomes. And so the best way to do this is a couple of ways. Any sort of body composition tests can do this. So whether this is a scan through like a DEXA scan, which is a gold standard or other ways of biological, bioelectrical impedance or otherwise. So there's a ton of different tests you can get that are pretty close. So what you want to pay attention to when you get a DEXA scan is a number called FFFMI. And so that stands for "fat-free mass index." So you can look at again, any number of online calculators.

01:28:10 These are all standard, so it doesn't actually matter where you pull them up. You don't have to worry about looking it up and whether or not it's right or not or something. And so that's going to actually tell you if you have sufficient muscle mass. And so a number you want to look for, in general, is something like if you're a man, your FFMI should be something like 20 or higher. If you're a woman, you want to look for something like 18. So those are the targets. If you get past 24, 25 for a man,

01:28:36 that's a lot of muscle mass, assuming you're reasonably lean. Now, if your FFMI is like 24, 25 but your body fat is 40%, you're actually just a very, very large individual. You're not in a great spot. So when we say these sort of numbers, it's the assumption that you're probably sub 30% body fat for a man and sub 35% for a woman. So those are the numbers. There are online calculators. All you really need to know is your total body weight, your body fat percentage, and then your height. And you can enter those three numbers,

01:29:07 and then they'll tell you your FFMI score, and it'll correct for an adjusted value. And then most of those will actually tell you the grading rubric and then they'll say, good, average, bad, et cetera, but those are the numbers we look at. If you are, as a man, sub 17, as a woman, sub 15, now we're in an area of pretty severe physiological detriment for insufficient muscle. And in some of our later discussions, we'll talk about why that matters. ANDREW HUBERMAN: So that's not sub 17% body fat. That says specifically, the FFMI.

01:29:37 ANDY GALPIN: That's correct, yeah. ANDREW HUBERMAN: What about muscular endurance? Is this where you're going to tell me I need to do wall sits? ANDY GALPIN: So this is really nice. You can do any number of tests here. A standard plank it is a good test of muscle endurance. So can you hold a front plank for 60 seconds? Can you hold a side plank for 45 seconds? Pretty easy. If you're able to do a push-up. So if you can't, that sort of tells you alone. It's actually interesting. If you can't do a single push-up,

01:30:06 that's not a muscular endurance issue. That's actually now a strength issue because that's a one-rep max problem. So we want to be able to-- again, for a general male, we should have no problem doing 25 plus consecutive push-ups. ANDREW HUBERMAN: I apologize for interrupting you, but as long as we're talking about push-ups, could you just mention form? Are we talking chest touching the ground? Elbows breaking right angles? What is a proper push-up, according to your laboratory? ANDY GALPIN: Unless you have a very specific reason

01:30:35 to limit range of motion, I want all my testing done through a full joint range of motion. This is different for the person. So it's individualized to them, but in general, for a push-up, this would be a full complete lockout of the elbows on the top and a full chest touch or close to it at the ground. You can do it different. It doesn't really matter, but just keep it standard from your pretest to your post-test if you're trying to mark progress, but for us, unless we have a very specific reason,

01:31:01 we're going full range of motion for all of these tests. ANDREW HUBERMAN: OK. So 25 push-ups for a male. ANDY GALPIN: 25 push-ups for a male is the standard. And even something like 10 is a number we're looking for, again, as minimum categories for an upper body muscular endurance. ANDREW HUBERMAN: And not to get too down in the weeds, but I have observed other people-- of course, never myself. No, I'm kidding-- but observed other people pausing maybe at repetition 15, catching their breath and then continuing.

01:31:29 ANDY GALPIN: That would be a fail test. ANDREW HUBERMAN: So continue like a piston. ANDY GALPIN: That would be a fail test. ANDREW HUBERMAN: So no pauses. ANDY GALPIN: Correct. ANDREW HUBERMAN: Just up down, up down, and trying to hit at least 10, but ideally 25. ANDY GALPIN: I learned this lesson in one of our studies, probably nine years ago, where

we didn't clarify that. And so we actually had an individual-- he wasn't being nefarious. He just figured out, if I do a couple, take a quick break

01:31:51 and do a couple, he quadrupled his post-test results from his pre-test result because he figured out that little hack. So you want to standardize it. It's not that I'm against or have some sort of strong belief. It's just trying to keep protocol standardized, which means any break, failed test. ANDREW HUBERMAN: So 10 to 25 push-ups, minimum, for males. What about for females? ANDY GALPIN: So I'll clarify. If it's sub 10 for a man, that's again, and you're like, very severe red flag problem. We really, really like to see a number above 25.

01:32:23 That's where we're anchoring. Anything between 10 and 25 is like, yeah, but not severe. ANDREW HUBERMAN: It means they have work to do. ANDY GALPIN: We have work to do. ANDREW HUBERMAN: And for females? ANDY GALPIN: For a female, you're going to scale that back. So a female, the answer could be as little as zero. So you're going to see that, can you do a full position? If they're in that position, we're generally not going to do a muscular endurance test from the knees. We already know the answer is you're zero.

01:32:48 We'll actually default to another test, which I'll talk about in a second here. So for those folks, that's going to scale down a little bit. So basically, you're looking at 15 is that marker, like 25 was for the male, where I want to see above 15. And if I do, we're good. Anything between five to 15 is the number of, OK. If you're sub five, we generally have some problems. And if that is different, between one and zero, then zero is a problem. So we should be able to do that. ANDREW HUBERMAN: So if a female cannot do 10 full push-ups.

01:33:22 ANDY GALPIN: Yeah. 10 full push-ups hard for a female, depending on size. ANDREW HUBERMAN: OK. Let's say a female can't do five full push-ups. You said, rather than go to a knees-down version, what would you do to assess their muscular endurance? And would you then also encourage them to work on their strength? ANDY GALPIN: Well, absolutely. So again, if they can't do-- they can do anything less than three, you're going to be strength. In fact, if you want to look at muscular endurance in general--

01:33:50 so this is a bit of an off topic, but I promise I'll keep it short, and I'll come right back. When I was a doctoral student, I had two lab mates. One of them was a runner, a female, 120 pounds, something like that, small. The other one was a male, and he was basically like a straight bro, he lifts weights, doesn't do any other sort of training. Does a very classic not training program, but kind of training. And they were bantering back and forth for a while. And basically she was saying, you're so unfit.

01:34:17 You can't run at all. And he's saying, you're so weak. You can't do a pull-up. And so they challenged each other to a competition. They said, at the end of the year, the girl is going to do 26 pull-ups, and the guy had to run a marathon, so 26 miles. So that was the thing. And then there was some sort of consequence for whoever failed. So the guy quickly tried to figure out, how the hell am I going to run 26 miles when I have not run a mile in many, many, many years? So he just started running, three miles, four miles,

01:34:44 whatever. Well, of course, both of them ran immediately to me. And then she was like, how the hell? I can't do a pull-up. And I was like, great. And I gave her a very specific maximal strength protocol. And she was like, whoa. I want to go to the assisted pull-up machine and work on doing sets of 25 because I've got to get my muscular endurance up. And I tried to explain to her, your muscle endurance is irrelevant if you can't do one. It's never going to matter. She did the muscular endurance protocol, the entire thing.

01:35:11 Didn't listen to me. The end of the year came. She still produced exactly zero pull-ups. So the point is, if you look at muscular endurance, where is it strength and where is it actually muscular endurance? The general number that you're looking for is under 80%. That's going to tell you, is this a muscular endurance problem or is it an absolute strength problem? ANDREW HUBERMAN: Under 80% of a one-repetition maximum? ANDY GALPIN: Yup. So what I mean by that is this. In fact, this actually is in your question.

01:35:39 The other way to assess muscular endurance is take the exact strength tests you did from the talk five minutes ago, which one did you do? Load that to 75%, and then do that for as many repetitions as you can. And that is a tremendous barometer of muscular endurance. So if you were able to do 200 pounds in your leg extension test, put 75% on that and do that as many reps as you can. You want to look for more than eight repetitions. If you are below eight repetitions, then we have a muscular endurance problem.

01:36:09 If it is higher than that, if you've got 15 or 20, then we know we have probably some problems in your peak strength or the test itself. So that is a good-- eight to 12 number is where you want to be looking at for there. ANDREW HUBERMAN: What about anaerobic capacity? ANDY GALPIN: This one's more challenging. You either have to go to a laboratory and do something like a Wingate Test. So this is a 30-second maximal test where you're going to see how much work can you possibly do in that 30 seconds.

01:36:41 If you don't have access to laboratory, you can do this on any protocol you want. This could be sprinting. This can be on an air bike. This could be on a rower, anything like that, anything where you can exert maximal effort and you don't have to worry about technical problems. So I generally don't like to do things like a kettlebell swing or something like that. There's just too

many other variables. You need to be able to go as hard as you possibly can, knowing you're going to get to a place of tremendous fatigue.

01:37:10 Now, in the lab, we often use what's called a Bosco Protocol. And you're going to stand on a force plate, and you're going to do as many vertical jumps as fast as you can, as high as you can, for 60 seconds. And you are absolutely destroyed by second 45. So we'll either use that Wingate Protocol or that Bosco Protocol. If you want, though, again, take any of those other places, 30 seconds or so, up to 45 seconds, up to a minute if you want, it doesn't really matter. And you just mark down the distance you cover.

01:37:38 That's all. We don't really have standards for these things because it's going to be different. How far you can travel in 30 seconds on a treadmill is just going to be so different than sprinting in the field or on the assault bike or whatever. So what you really want to worry about there is, can you complete it? And then how awful do you feel afterwards? So what you really want to think about here is not those protocols, but this. You want to think about can you get close to your predicted maximum heart rate?

01:38:11 So the number we throw out is 220 minus your age. So if you're 50 years old, 220 minus 50, you should be able to get to a maximum heart rate of around 170 beats per minute. Now, that number is extremely generic. If you don't get there, that doesn't have any indication of your fitness. If you get higher, that doesn't mean you're any more fit. It's just a rough number. So here's what I want you to do. In this case, your heart rate recovery is the better metric. So I want you to get up to a maximum heart rate

01:38:41 and then test your heart rate recovery. And what you should be looking for there is about a half a beat recovery per second. So you're going to get up to a place where you reach absolute terrible exhaustion, maximum fatigue, test your heart rate, and then count. Have a timer going. Within 60 seconds, you should have, again, that half a beat per second. You should have a heart rate recovery of 30 beats per minute. Within the next minute, so two-minute recovery, it should be, again, half that, so 60 beats.

01:39:13 Those are rough numbers to go by. And your three-minute recovery is, again, half of that again. So that is the closest way. If your heart rate recovery is worse than that, then we know we have a problem in your anaerobic capacity or your cardiovascular capacity. ANDREW HUBERMAN: I love it. What about number eight, maximal heart rate? Because what you just described sounds a lot like maximal heart rate. ANDY GALPIN: So this is your VO₂ max. So the gold standard here is to actually go into a laboratory

01:39:39 and get this thing done. So we can actually run a VO2 max test, where you put a mask on, collect all your gases, and run you to there. And there is a very specific protocol for completion of a true maximum test. And any scientist will know that. If you don't have access to that, you can do a couple of tests. One of them is called a 12-Minute Cooper's Test. So this is simply time. You're going to run for 12 minutes as far as you can, and you're going to record the distance you covered. Again, you can go online to any number of calculators,

01:40:09 enter that distance in. And that will tell you your proximal or estimated VO2 max. ANDREW HUBERMAN: So that's a 12-minute sprint. ANDY GALPIN: 12-minute sprint, maximum distance you can cover in 12 minutes. ANDREW HUBERMAN: Keeping a steady pace the whole time or going-- ANDY GALPIN: Do whatever you want. The goal is to get maximum distance covered in 12 minutes. So that's anywhere between a mile to two plus miles, depending on how fit you are, but you just do that Cooper 12-Minute Test. ANDREW HUBERMAN: Got it.

01:40:37 ANDY GALPIN: I told you. So if you remember, aerobic capacity is eight to 12 minutes where you're going to see a real true test of that VO2 max. You simply can't get that in under a few minutes. So if you want, you can do a little gentler version of that. So there are a number of submaximal tests. In fact, there is a one-mile walk test you can do. So again, all you're going to do is-- in this case, you have to have of either a stopwatch or, ideally, a heart rate monitor. And all you have to do is-- this is a walk for one mile

01:41:11 submaximal test. So you're going to walk a mile, record the time, record your heart rate at the end, enter those in. And those will give you, again, estimates of your VO2 max. So that's the like, oh my gosh, I can't run for 12 minutes as hard as I possibly can or I don't want to do it. We have a lot of these in our executive program. It's like, my knee hurts too bad. I've got back pain when I run or whatever. Can I-- OK. And you do the walk test. And it's pretty accurate if you do it correctly.

01:41:37 So technically, all you have to actually do is measure your heart rate on you neck and count 60 seconds, but it's just easier to-- with everyone's watches and stuff now, just wear the heart rate monitor, plug in those numbers. And again, those are all standard calculations. So anywhere you find those, you don't have to worry about the source. So you just enter your stuff in, and they're going to be running off the same equation. ANDREW HUBERMAN: I like the idea of the 12-minute run. I'm going to give it a shot, see what happens.

01:42:04 ANDY GALPIN: For years, we did a one-mile version of this, and there's just a lot more science on the 12-Minute Cooper Test. So we did that. It's pretty good, and it is not even remotely close to fun. ANDREW HUBERMAN: It sounds like fun for other reasons. ANDY GALPIN: Yeah, yeah. Well, it is it. ANDREW HUBERMAN: Fun in the sense that it reveals a lot. ANDY GALPIN:

Yup. ANDREW HUBERMAN: It's powerful, potent. ANDY GALPIN: Super. There's no hiding. You can hide with the leg extension test. It doesn't hurt that bad.

01:42:32 But you cannot feel anything but the 12-minute "run as far as you can" test. ANDREW HUBERMAN: So these are really, actually, psychiatric diagnostic tests-- ANDY GALPIN: They are. ANDREW HUBERMAN: --of a sort. ANDY GALPIN: For sure. ANDREW HUBERMAN: Number nine, long-duration, steady-state exercise. I think of this as a.k.a. endurance, but as you mentioned before, there are other forms of endurance. So long-duration, steady-state exercise. ANDY GALPIN: Yep. So you really want to think about this

01:42:59 as not a standard number. You should maintain consistent work output for over 20 plus minutes. And this one I want you to just pick something that it was in your lifestyle. So is there a loop around your house that you can do? Is there some protocol that you like to use before? And you're simply going to test your ability. Can you maintain work without stopping? That's all it needs to be. Now ideally, I personally like to throw a little twist in here, which is, can you do this with nasal breathing only.

01:43:30 That's when I feel really good. If you can go 30 straight minutes without needing to take a break-- walking doesn't really cut it unless you're very, very unfit, in which case, if walking 30 minutes without a break is a challenge, OK. There. But if you can, I want you moving at a non-walking pace. I don't care what zone this is, two, three, four, five. I don't care. Show me you can maintain minimum of 20 minutes of work with no breaks, no intervals, no downtime and, again, ideally breathing through your nose only.

01:44:00 ANDREW HUBERMAN: I love this list, but it worries me a bit. Not because any one of these tests is necessarily that overwhelming, but because I'm unclear about how to arrange performance of these different tests. ANDY GALPIN: Yeah. ANDREW HUBERMAN: For instance, do I separate them so I'm doing one test, like long-duration output on one day and I'm doing strength on another day? Those seem pretty obvious to me, but are there ones that one can combine on different days? How much time should one give oneself in between these tests?

01:44:29 And how often should one do an assessment? Just as we don't want to necessarily evaluate body weight changes by getting on the scale three times a day, maybe once a day at the same time each day is more practical. How often should we be assessing our fitness for each and every one of these? ANDY GALPIN: Well, the way that I would say this is, you want to pick the one that is the worst and do that more frequently. So if, for example, you do the upper body strength test and you are fantastic, if you can bench press double

01:44:59 your body weight, I don't need to test your bench very often, for the average person. If you're not a powerlifter, maybe once a year or something. Maybe not even that. We just don't need to get there. However, if we then test your VO2 max and in your 12 minutes, you cover a total of a half a mile, then we might want to test that every month. And so we're going to let our priorities emphasize which one we're going to do more often. I would recommend doing this full battery once a year. ANDREW HUBERMAN: Full battery, meaning the entire list

01:45:29 on one day. ANDY GALPIN: No, not on one day, but within a week. So you could take a week. Now, you could do these, technically, all in two days. Three-day split here is probably best. So if you were to just say, hey, this is testing week. I actually love this for beginning of the year or whenever it is that you change your training, but I think once a year, just like once a year you should probably go to a physician and get full bloodwork, a full heart scan and everything like that. And then if maybe you had a heart issue,

01:45:58 they would come back in and test you more frequently, whatever the case is. You should probably run through this. And you're going to be thinking, yeah, but I don't want to give up on my exercise routine that week. Well, I promise you, you're not going to finish this week and think, I didn't do very much work this week. It's going to feel great. And then you're going to have a very nice barometer of exactly where you need to change and prioritize your training for the next quarter or half a year

01:46:20 or wherever you want to go. If you want to actually do this every six months, we end up, actually, doing this, quite honestly, more like every six months as a general test. That's a really good way to do it, but minimum, if you're arguing with me, give me once a year that you want to do this. So which order to do them in? The non-fatiguing tests, you can do whenever. So this is the body composition scan, the FFMI, the body fat composition. All this stuff can be done whenever. I generally like to do that, though,

01:46:48 as your very first activity. The reason is we know that acute exercise can heavily influence things like body composition measurements because of inflammation, water storage, et cetera. So it's easiest to just get that off of a 48 hour rest. You want to make sure you don't do any hard exercise the day before a body composition test and probably 48 hours before that. So just start yourself off with that. Your movement tests can be the same thing. You don't want to try to do a assessment of how well you're

01:47:16 squatting if you're incredibly sore from your brutal squatting test. So tend to do those things when you're the most fresh. Then what you want to do is any skill or maximum strength or power goes at the very beginning of the day. And any fatiguing thing happens at the end. And so you could easily do this. All right, I'm going to do my power test, my broad jump, great. You're not

going to be fatigued at all from that. And on the same day, since I'm already pretty warmed up, now I'm going to roll right into my leg strength test.

01:47:48 And since I'm really warmed up, I'm going to do my leg muscular endurance test right there. So this is a very common strategy we use. We do our one-rep max leg extension, five minutes, seven minutes, whatever we need to do, come back, load it to 75%, do as many reps as you can. Boom. You could roll right into, then, your upper body test or your grip strength test or anything else that you want to do there. Is there a little bit of influence? Yeah, but really, for most people, it's not that bad.

01:48:15 What influence I mean. If you do a leg strength test, coming back and doing an upper body strength test afterwards, it's not that big a deal. Give yourself 15, give yourself 20 minutes. Give it plenty of time. So you can knock out your strength testing and muscular endurance testing all in one day. You could do your performance, your skill diagnostic, your power jump test, your strength, and your muscular endurance, and all that stuff is knocked out. You're going to have to come back on a separate day

01:48:42 and do your anaerobic tests. This is 30-seconds maximal endurance, things like that. You could, though, if you wanted, do that after your long duration tests. You're long duration test again, is just going to function as a big, warm up. Or you could flip those things or you can do them on separate days. You're going to have to do your VO₂ max test on its own day, for the most part, unless you wanted to do, again, your movement or your body composition before those things. So you really have the ability to mix and match.

01:49:12 Ideally, this most realistically probably takes three days. If you want to separate them into four or five, the more separation you do, the better data you're going to get. It's just a question of how pedantic are you really trying to get here? And are you willing to lose 5% to then save a whole day? Then you can do these things in multiple stacks. So that's how I would break it up. ANDREW HUBERMAN: So what I'm hearing is, better to do it than to not do it. ANDY GALPIN: Most definitely. ANDREW HUBERMAN: And be rational.

01:49:40 Don't try and do your strength output late in the day when you're fatigued. If you're going to combine some of the steady state endurance and maximal heart rate, fine. Understand there might be a slight deficit there, but test it the same way each time. And what you're really looking for is improvement. ANDY GALPIN: Yep. And you can also do the heart rate recovery under any of the modalities. So you could do the heart rate recovery after your VO₂ max as well. So you finish that thing, and then just, again, do the same test for up to three minutes.

01:50:08 ANDREW HUBERMAN: These are fantastic tools. I'm almost tempted to say that I'm willing to post my numbers, but that actually violates the core principle that I think we're getting at here, which is that it's highly unlikely that anybody is going to be phenomenal across the board. I mean, certainly there will be individuals that are, but based on everything we talked about earlier, specificity of training and how extensively somebody has been training a certain way will, without question, lop side them, if you will, toward being

01:50:37 better in some of these assessments and less good in others. And that's just simply the way that these adaptations work. ANDY GALPIN: Yep. You don't need to be optimal in all of these areas to be, quote, unquote, "optimal health" from this perspective. You just want to make sure, again, there's no severe performance anchors. This is what we call them. We don't want any of these severe constraints because you're going to get limited by that thing. And so what you want to do is move that up to just sufficient or concerning and get it away from that.

01:51:09 If you do that, that thing's not going to catch you. You're going to be able to continue to pursue optimization in any of the one things that you have a specific passion for, which is generally what moves people. You train so that you feel better. You train because you know there are all these benefits to it. And jeez, this audience probably could list hundreds of them. But you also train because you generally like to get better at something. A lot of us have something. And so you want to make sure that you're not going,

01:51:36 hey, I know you're good at endurance, but you really shouldn't train anymore. We don't want that message, not at all. I want you to love your training. We just want to make sure that you're not loving that so much that you're not taking some blinders off and missing another area, which would actually-- again, you pull that performance anchor, this whole ship sails faster, with less effort and less friction. ANDREW HUBERMAN: What I love about this is also that, as you've described it, it's not just

01:52:04 for athletes or people that are super into fitness. It's also for people that just want to be healthy and want aesthetic changes. And that's why they're exercising, which, I think, accounts for a fairly large percentage of people out there. So I think what you described is incredibly well-structured, incredibly clear, and incredibly actionable. So I want to thank you for that I'm serious about my willingness to do this and at least share those numbers with you. And I think for most people that are seeking what you listed off

01:52:36 before aesthetic changes, functionality, and longevity, it's clear that all nine of these are going to be important in some regard or another. ANDY GALPIN: So before we close out, I want to go back and finish off the metrics for VO2 max because I don't actually think I gave you numbers on that. So in general, for men, a minimum number we want to look at here is 35 milliliters per

kilogram per minute. And for women, that would be about 30. So we can actually push a lot higher on those things. In reality, I want to see men above 50.

01:53:06 ANDREW HUBERMAN: If I could just interrupt you for a second. When you say 40 milliliters per kilogram, milliliters of what, specifically? ANDY GALPIN: Yeah. So what, actually, those metrics mean is the first one, milliliters, is oxygen. So it's amount of oxygen. Kilograms is body weight. So it's, how much oxygen can you bring in per kilogram of body weight per minute? So does a volume of oxygen per your size in a time duration. In fact, the way that you calculate it is you multiply your cardiac output by what's

01:53:37 called your a-vO₂ difference. Your cardiac output is your heart rate times your stroke volume, so how much blood you're pumping out per pump is your stroke volume. How many times you're pumping or you're beating. You multiply that by your a-vO₂ difference. Your a-vO₂ difference is artery minus vein difference. So it's the amount of oxygen in your arteries minus the amount of oxygen in your vein, which is going to tell you how much you took up in your capillaries, in your muscles. So you take those two factors, multiply them together,

01:54:04 and there's your VO₂ max. ANDREW HUBERMAN: As you were describing that, I imagine you getting to an fMRI machine and seeing that equation lighting up in your brain because clearly, it's committed to memory very well. Thank you for that clear description. ANDY GALPIN: Yeah. So to finish those numbers, I really, truly want to see a man above 50-- and I'm not even really stoked until I get above 55. In fact, it's sort of funny. Dave Costill, whose lab I did my PhD in-- he was retired by the time, but he's, again,

01:54:31 one of these legendary figures in exercise physiology, started in the '70s. He would always say, "There's no human excuse to be below 60," which I was always like, damn. That's really, actually, pretty hard to get to. ANDREW HUBERMAN: Was he at 60 or above? ANDY GALPIN: Oh, yeah. he's still, actually, setting world records in these last couple of years, all the Masters records for swimming and cycling and stuff. So he was a super, super fit guy. So he was always above 60. He's probably like 50 something now,

01:54:59 even though he's 80 or whatever. ANDREW HUBERMAN: 80 years old. ANDY GALPIN: Yeah. ANDREW HUBERMAN: With a VO₂ max of 50. ANDY GALPIN: He's probably really not 50. He's probably-- but he's probably going to-- remember earlier on we talked about how I had the 92-year-old who had VO₂ max of 38. Dave's probably going to break that record when he gets there, I'm sure. I'm sure. In fact, I guarantee you he has that number in his brain. I haven't talked to him in 15 years, but I guarantee you that number is in his brain,

01:55:22 and he's probably training for it. ANDREW HUBERMAN: I love it. And I love it because it proves that exercise pays off. ANDY GALPIN: Oh, yeah. ANDREW HUBERMAN: It's one of the few things in life where there's a direct relationship between work and outcome. ANDY GALPIN: Yeah. As Henry Rollins described in his wonderful essay, if you're familiar with that. Oh my gosh, you're a punk rock guy. You know Henry, I'm sure. ANDREW HUBERMAN: I mean, I certainly know who he is, and I know his work. ANDY GALPIN: Yeah.

01:55:47 He has incredible one-page paper. It's something to do with the iron. And he basically describes that as, this is the one thing where it's truth. It is the most true thing you'll ever do, which I love that. ANDREW HUBERMAN: It's almost like a principle of nature. ANDY GALPIN: 100%. Yeah. So with the women, I really want to see the women-- if I want to see men above 55, I really want to see women above 50 as the target. And if you like, you're there, I'm pretty good. So you can do the math on, then, the middle ground of what's

01:56:16 like OK, but we need to work on it. In fact, if you look across the literature, at different athletes, you're going to see the really high-level endurance folks, they may pass 70 or 80. In fact, there was talk a few years ago of a guy breaking 100 as an 18 or 19-year-old, but I actually don't think it was ever fully confirmed or repeated, but certainly, you'll see plenty of people 95, in those extremes. If you look at other sports, like football or basketball, they're probably going to be in the 55, 65 range.

01:56:49 So if you, as, an average person are 55, that's a really good marker to be in. If you get even close to that, you're in a good spot. I'm sorry if I let you down, Dave. ANDREW HUBERMAN: No. I just love how you're describing this average person, you're looking at me with just a little bit of sympathy, like if you reach the standard of average, Andrew. Listen, you're giving me prompts all over the place to try and improve my metrics, whatever they happen to be. And I think that's one of the great values of getting

01:57:14 objective numbers, even if they have to be measured by some of these back-of-the-envelope techniques that, I guess, we always teach people in the laboratory, that a tool can be not extremely precise, but as long as it's reliable, there is still value there. I mean, of course, you'd love to have the most precise and most reliable tool, but if you can't, then at least go for a reliable tool and measure for consistency. ANDY GALPIN: Yeah. For the real world, reliability beats validity as much as we can.

01:57:44 For a lot of the things we're talking about, especially for using it as a metric of did I get better, as long as that tool is reliable. Body composition, just all of these things have inherent error in them. Some of them are smaller, some of them are larger, but as you mentioned, having standardization within the testing protocol is going to allow you to measure progress. And that's

going to tell you sort of where you're at. Now that we've covered all these areas of adaptation, we walked through the history, and we

01:58:09 walked through a bunch of the explanations for why people are maybe not getting the results that they want to get through their training, the way I would like to go with the rest of our conversations would be to just go through each of those adaptations step by step and make sure I cover very specific protocols for, if you have run through this testing and identified an area of weakness. So maybe you've been lifting a lot because you like lifting, and you maybe realize that your cardiovascular fitness

01:58:35 or your heart rate recovery is not where it really should be or the opposite, like we've talked about. Maybe you're doing a lot of that type of work, and your strength isn't there. Your movement quality is not there. So you've identified a problem. How do I specifically solve it? What are the evidence-based and most effective protocols that I can put myself in for each one of these categories? And I think that would give people a lot of take-home value, but it's going to take us some time to cover.

01:59:01 So it's going to have to come across over multiple conversations between you and I. ANDREW HUBERMAN: Great. Well, I'm looking forward to each and all of those conversations. And I want to add just one more metric to our discussion today, which is really just my way of saying thank you because if there were a metric for amount of useful information per sentence spoke, you would be at the upper level of that metric. You have this amazing ability to provide so much knowledge in a clear and concise and, today, listed-out format that

01:59:35 is both interesting, grounded in science, and actionable. So on behalf of everyone listening, and certainly for myself as well, I just want to say thank you. ANDY GALPIN: Well, I appreciate the compliments. And I'm looking forward to the next conversation, jumping right into speed, strength, and hypertrophy training and what are the evidence-based and best practices for protocols in those areas. ANDREW HUBERMAN: If you're learning from and/or enjoying this podcast, please subscribe to our YouTube channel.

02:00:02 That's a terrific, zero-cost way to support us. In addition, please subscribe to the podcast on Spotify and Apple. And on both Spotify and Apple, you can leave us up to a five-star review. If you have questions for us or comments or suggestions about topics you'd like us to cover or guests you'd like me to include on the Huberman Lab podcast, please put those in the comment section on YouTube. We do read all the comments. Please also check out the sponsors mentioned at the beginning and during today's episode.

02:00:26 That's the best way to support this podcast. I'd also like to inform you about the Huberman Lab podcast free newsletter. It's called the Neural Network Newsletter. And each month, the Neural Network Newsletter is sent out, and it contains summaries of podcast episodes, specific protocols discussed on the Huberman Lab podcast, all in fairly concise format, and all completely zero cost. You can sign up for the Neural Network Newsletter by going to hubermanlab.com, go to the menu and click on Newsletter.

02:00:52 You provide us your email. We do not share it with anybody. And as I mentioned before, it's completely zero cost. By going to hubermanlab.com, you can also go into the Menu tab and go to the Newsletter and see some example newsletters from months past. Thank you once again for joining me for today's discussion about fitness, exercise, and performance with Dr. Andy Galpin. And as always, thank you for your interest in science. [MUSIC PLAYING]

00:00:00 [Music] welcome to the hubman lab guest Series where I and an expert guest discuss science and science-based tools for everyday life I'm Andrew huberman and I'm a professor of neurobiology and Ophthalmology at Stanford School of Medicine today's episode marks the sixth and final of the sixth episode series on fitness exercise and performance and today's discussion is all about nutrition and supplementation to maximize your fitness exercise and performance goals Dr Andy Galpin I'm super excited to discuss today's topic

00:00:31 which is nutrition and supplementation for performance and recovery and I'm particularly excited about this conversation because I've been interested in supplementation and nutrition for performance really since my teens but also because in recent years we've witnessed a massive transformation in the general public in terms of their view of supplementation and nutrition first of all more people are thinking about nutrition what is good nutrition what is not a very barbed wire topic as you know but there are some truths in there that

00:01:00 we'll discuss but also supplementation you know whereas 105 years ago I think most people um would either be really into supplements that was a small percentage of people but the majority of people uh were either told or were thinking oh you know vitamins you you mostly excrete them they're just expensive urine nowadays it seems that many people including many of my colleagues and Physicians all the way down to sports performance experts are taking and making recommendations about certain supplements and so the way that

00:01:32 I like to think about supplements is that they aren't necessarily just supplements which makes it sound like they are augmenting what should already be there but you're not quite getting enough of but indeed a lot of these things we call supplements are very potent compounds that can transform our ability to perform in the short term to recover from exercise and that can really shape brain chemistry hormone patterns acutely and when taking long term term so I'm very excited about today's topic and to be able to try and

00:02:04 sort through this let's call it a cloud hopefully not a storm but this cloud of supplements that are out there because indeed many of them are excellent and can provide us a lot some of them are terrible and then some just don't do anything and therefore are terrible because uh either they have side effects or because they're very expensive and they don't do anything and then of course within the realm of nutrition there's an equal amount of of confusion but that's why I'm talking to you because

00:02:32 you're going to put Clarity and structure and definition on these incredibly important topics you you absolutely nailed it there one of the major reasons supplements can work is because you can consume nutrients in extremely high concentrations such that you would not get in nature through food having said that you really do want to focus on the basics sleep nutrition hydration and I'm going to get into very specific detail later with some of those things that said there are plenty of situations in circumstances when

00:03:01 supplementation can do exactly what you said also though because you are taking them in such high concentrations they can also be unproductive they can be destructive or they can be counterproductive so in case if you're taking a couple of supplements over here it may actually be counteracting the benefits of some of the other supplements over there so in the ideal situation we would be able to work like snipers here so we would be able to run full biological testing so extensive blood work and saliva and

00:03:31 urine and stool and have an in-depth analysis of your gut microbiome and your stress patterns and your time of day and your cortisol curve and like all the things that we do in our high performance folks with that then we can get extremely high Precision supplementation and and quite honestly our philosophy is we only give individuals exactly what they need so even some of the standard uh generally safe and effective supplements we don't really necessarily use them if there's no specific need we've talked about the consequences of

00:04:00 this with things like antioxidants but even simple stuff like stimulants and other tools that are effective for Recovery we don't use them unless we have a reason that said that's not the reality for a lot of people they're not going to be able to do something like that or somebody who can help them in that so there are a handful of supplements that I would consider to be in my my 8020 rule which is sort of like the 20% of supplements that are going to give you 80% of the benefit for the lowest cost and so what I can actually

00:04:28 do is just sort of start there even though this like burns my skin and my soul a little bit I absolutely hate this I am the context guy I'm the it depends it's high Precision guy but let's be

real um there are a number of supplements that are fairly effective and fairly cheap for a wide range of outcomes uh so this is for general public this is for people who want to do the three buckets right you want to look a certain way so supplements that could enhance muscle growth and fat loss uh non hormonal based supplements of course

00:04:58 supplements that can improve energ or physical performance again from everything from you know squatting more to feeling better in your yoga class to having more energy throughout the day to our third major bucket that we've been talking about throughout this entire series which are longevity so we can cover those first if you'd like to start there yes absolutely let's start there often times when we think of supplements we immediately jump to High Sport performance type of things or vigorous workouts or or muscle building though

00:05:25 that doesn't necessarily have to be the case uh take for example creatine and I've spoken about this at length and with gu Darren kandow who's done a tremendous amount of research I was just up at his lab recently in Canada and he has covered extensively in fact I I think I put up a post perhaps I could draw this up um where he laid out all the Myriad of benefits of creatine this is taken in the you know typically 3 to five grams per day of dose of creatin monohydrate which has the most research

00:05:51 behind it um seems to be extremely low side effects in almost anyone and the benefits include in course things like uh muscle performance and strength and things like that and if you go back to our discussion and our episode on metabolism and and endurance uh we talked about the phosphocreatine system so you can figure out kind of what this is going to do in terms of effect that said there's excellent information and data coming out and on on the benefits of bone mineral density in creatine U there's a ton of work looking at a host

00:06:23 of cognitive factors um from memory executive function uh to effects potentially on even things like depression mood to alzheimer's Parkinson's uh all forms of of neurogenerative disease u in fact it's it's pretty obvious the brain loves creatine as a fuel and so not only we sort of discussed in the episode as being the fuel for skeletal muscle contraction but the brain needs to do that as well the asites around the brain need to be able to provide energy Etc so it's very clear that metabolism in the

00:06:55 brain is reduced with things like TBI and potentially concussions so um now to be extremely clear creatine does not prevent any of those diseases it does not treat any of them and the data are mixed but it more and more are coming uh some show a little bit of benefit some show you know maybe none but I'm not aware of any research in those areas that show it has any downside for the most part side effects are extremely minimal if not null and then potentially some benefit depending on the specific

00:07:26 study so we could put up a if you'd like a couple of links directly to those meta analyses and folks can go through those things one by one so um I only say that to again maybe expand our understanding or thinking about what these types of supplements can do it's not just about growing muscle or um you know high performance it's everything to again there's an association with recovery uh so is fantastic for recovery from muscle for muscle damage uh helps and can potentially aid in fat loss and a

00:07:54 whole host of things so you can actually also even look at websites like examin I have you know no affiliation with them whatsoever but if you want to just type in something like monohydrate you can see a whole list and you're going to see thousands of studies of the potential benefits of creatine so that is is always number one on my list I'm relieved to hear that creatine sits at the top of your supplementation list because uh well first of all I started taking it when I was in college at that

00:08:23 time I was taking it in this kind of loading mode where you take it in um you know anywhere from uh 15 to 25 gram per day often causing some gastric distress often combining with fruit juice to try and shuttle it into the muscles and then a so-called maintenance phase of reducing to 10 or 15 grams per day um nowadays I just take about five grams or so although later I know you're going to tell me why I should probably be taking more than five grams per day given my body weight so I know we'll get into

00:08:51 some of those specifics a little bit later but in addition to experiencing Direct effects on uh muscle size and strength which I did I don't know how it contributed to my cognitive function or if it does now because there's really no way to tease that out with standard um uh at home tests like a scale uh but it is very clear to me based on the literature uh that you described and some of which we've covered on other episodes of the podcast that the phosphocreatine system is vitally important for forbrain function right

00:09:23 the forbrain of course being the the uh portion of brain U broadly speaking the portion of brain just behind your forehead that is uh responsible for planning action setting rules in context so um even as simple as if you're going downfield in a game of soccer or basketball and you're on offense and then uh you make an attempt on goal or basket and then it switches and you go back now you're on defense that being on defense is very different than being on offense and that goal excuse me that that rule switching is a prefrontal

00:09:52 cortical function as is every context dependent way of thinking or or acting and so anything that can favor function of the forbrain I think is good for uh humans in general it

suppresses anxiety allows us to interpret what's going on for us and so I'm very um relieved and gratified to hear that creatine sits at the top of the list also as I'm sure you'll point out again later creatine is for the most part a relatively affordable supplement for most people so here we're not talking about something

00:10:19 that's really esoteric or that you have to you know fly to um some remote location to get an infusion of right um but although I apologize to all you CU I know the price has skyrocketed recently really yeah why is that uh I think it's a well nobody knows but it's quote unquote a supply and and uh demand issue if you will so uh those prices have gone up there's also of course been shipping problems in the world and things so uh every time I talk about creatin right now people just flame me for like oh my

00:10:47 God it's so expensive now I'm like I know I'm sorry but honestly it's only so expensive because you're used to it being so cheap so when you when you counter the fact that we like right yeah like relative to the other stuff you're probably taking relative to any other number of purchases um for the it still lands very high on my Roi List my you know my 8020 because of that it's um it can be taken any time of the day it doesn't have to be in magical combination you talked about coing esting with carbohydrates that can

00:11:14 enhance uh how quickly you can get into the system in fact it's it's going to work on the exact same mechanisms we'll probably or potentially talk about hydration um but these things are shuttled so anytime you bring in carbohydrate that's going to be shipped into tissue as quickly as it can uh creatin goes along for the ride and then it brings water for the ride that's how you enhance hydration that's why it's important to have carbohydrates when you're trying to hydrate um so you're just going to take it in there and

00:11:37 that's also why you get quote unquote cell swelling um which is a good thing like you're it's just enhancing hydration we actually use it a ton in our post weigh-in protocols so individuals that have to cut water weight is a great thing to throw back in there it's going to help you rehydrate it's also why when you take 30 grams of it it can pull a bunch of fluid in the intestines and and there you go with your little bit of GI distress so um yeah there's a lot of fun things you can talk about there um I just had to

00:12:02 flag that because every time I've been talking about it recently and I say it's Jeep people are killing me for it so I apologize I don't know how to make it any cheaper but it's still fairly fairly affordable yeah I would say relatively inexpensive compared to a lot of supplements out there and when thinking about the return on investment is U it's quite good yeah like actually sorry sorry to cut you but I was just also thinking um there's been a number of studies on uh sleep deprivation as well

00:12:26 with that can help so obviously sleep deprivation will generally reduce cognitive function and creatine can ameliorate some of that drop so if you think about it in that context I had a crummy night of sleep well and if that enables you to perform a little bit better in your job then you would make up the dollar or so whatever you paid for that day's supply of creatine so um it is something kind of on that note it's not going to work as an acute response so it's not something you're like I feel terrible let me throw some

00:12:52 creatine Down the Hatch I'll feel better that that's not going to work it's going to take several weeks to have a noticeable effect it needs to be stored in tissue uh it needs to be built up before you can actually do much of anything so it is unlike some of the other things like stimulants or caffeine that have an acute you know response right now uh and so if you're going to take it you probably need to consume it consistently if you can't do that then really there's no point in doing it uh and the loading phase you mentioned

00:13:17 distance were here is something you can do again if you need to enhance the storage of it really quickly so say for example we've done this in some military cases where it's like you get back to base and you you've only got a week and you got to go back out we may actually have to uh do a little bit of a loading phase then but if that's not the case um the loading phase is unnecessary it's not really harmful other than maybe G stress and maybe waste but you're going to have three or four weeks it's going

00:13:43 to reach full saturation plenty of time to be there in that if you're in that three to seven grams per day range I'm glad you mentioned the slow accumulating positive effects of creatine as compared to so-called acute effects because the way that I think of Health promoting and performance enhancing protocols like viewing morning sunlight or um endurance exercise for that matter or creatine or sleep for instance is that while they can have effects in the immediate term you might feel a little bit or in the

00:14:14 case of a good night's sleep a lot better it's really the cumulative effect of raising your Baseline level of functioning you know there's uh another way to think about it is um these supplements or behaviors um and quality nutrition when done consistently over time time and that doesn't mean 100% of the time but you know probably 80% of the time sure lead to a sort of uh buoyancy in your system that allows you to be more resilient under conditions uh where conditions aren't perfect right and if conditions are made perfect or

00:14:46 close to perfect and you already have that buoyancy that's when you really start to see the ultra high performance effects um that are so much fun but they have to be established

through consistent supplementation consistent nutritional intakes so today I know we're going to distinguish between uh normally they're called chronic and acute effects but that makes it sound like chronic illness the moment people hear chronic well they might think of other things but but in the context of Health they typically think of you know

00:15:11 chronic illness and we're not talking about that what we're talking about is slow modulatory effects in the body a lot of things in the body take time to build up but once they've built up they uh they clearly can benefit us um and then other things as you mentioned you know a stimulant for instance has a very acute effect that is going to occur with you know Peak within 30 minutes and wear off within you know 4 hours or so can also have some chronic effects but typically it's a short-lived effect so

00:15:37 we just want to frame up the the language that we'll be using and I'm really excited to dive into this topic and I think creatine is a beautiful example of a supplement that has positive chronic mental and physical benefits down the road I can come back and talk a little bit more about creatine and we can cover some other information regarding best practices for getting the most out of it as well as we'll certainly dive into some of the common side effects or at least a thought of side effects while we're here

00:16:05 though I also could throw in a few other of these high impact lowcost generally safe um things that are my 802 rule if you will so the way I actually kind of think about it is you want one from each of three categories uh and these categories are fuel stimulant and fatigue blockers so creatine is actually in the fuel it's not not a stimulant as we talked about The Chronic effect there so we've already knocked that one off another one from the fatigue blocker is going to be anything like beta alanine or sodium

00:16:38 bicarbonate and then from the stimulate use of course we have anything like a beetroot juice to a caffeine or uh something of the equivalent so we can come back again and talk about all those in more detail a little bit later before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford it is also separate from Dr Andy galpin's teaching and research RS at Cal State Fullerton it is however part of our desire and effort to bring zero cost to Consumer

00:17:04 information about science and science related tools to the general public in keeping with that theme we'd like to thank the sponsors of today's podcast our first sponsor is momentus momentus makes supplements of the absolute highest quality the hubman Lab podcast is proud to be partnering with momentus for several important reasons first of all as I mentioned their supplements are of extremely high quality second of all their supplements are generally in single ingredient formulations if you're

00:17:29 going to develop a supplementation protocol you're going to want to focus mainly on using single ingredient formulations with single ingredient formulations you can devise the most logical and effective and costeffective supplementation regimen for your goals in addition momenta supplement ship internationally and this is of course important because we realize that many of the hubman Lab podcast listeners reside outside the United States if you'd like to try the various supplements mentioned on the hubman Lab

00:17:54 podcast in particular supplements for Hormone Health for Sleep optimization for focus as well as a number of other things including exercise recovery you can go to live momentus spelled o us so that's liv.com huberman today's episode is also brought To Us by levels levels is a program that lets you see how different foods and activities affect your health by giving you real-time feedback on your blood glucose using a continuous glucose monitor many people are aware that their blood sugar that is

00:18:20 their blood glucose level is critical for everything from Fat Loss to muscle gain to healthy cognition and indeed AG of the brain and body most people do not know however how different foods and different activities including exercise or different temperated environments impact their blood glucose levels and yet blood glucose is exquisitely sensitive to all of those things I first started using levels about a year ago as a way to understand how different foods exercise and timing of food relative to

00:18:50 exercise and quality of sleep at night impact my blood glucose levels and I've learned a tremendous amount from using levels it's taught me when best to eat what best to eat when best to exercise how best to exercise and how to modulate my entire schedule from work to exercise and even my sleep so if you're interested in learning more about levels and trying a continuous glucose monitor yourself go to levels. link huberman that's levels. link huberman today's episode is also brought To Us by element

00:19:21 element is an electrolyte drink that contains the exact ratios of the electrolyte sodium magnesium and potassium to optimize cellular functioning for mental and physical physical performance most people realize that hydration is key we need to ingest enough fluids in order to feel our best and perform our best but what most people do not realize is that the proper functioning of our cells and nerve cells neurons in particular requires that sodium magnesium and potassium be present in the correct ratios now of

00:19:48 course people with prehypertension and hypertension need to be careful about their sodium intake but what a lot of people don't realize is that if you drink caffeine if you exercise and in

particular if you're falling a very Clean Diet that is not a lot of processed foods which of course is a good thing chances are you're not getting enough sodium potassium and magnesium to optimize mental and physical performance element contains a science spack ratio of 1,000 milligrams that's 1 gram of sodium 200 Mig of

00:20:16 potassium and 60 Mig of magnesium and no sugar if you'd like to try element you can go to drink element that's LM nt.com huberman to get a free element sample pack with your purchase again that's drink element lmnt / huberman to claim a free sample pack to start off I want to ask you about something that as soon as I say it some people might roll their eyes or wonder why are we even talking about that now but that I have to believe is among the more fundamental if not foundational aspects of nutrition

00:20:50 and supplementation for performance and that's hydration right I mean I think we hear hydration it's like okay we have to drink 68 glasses of water every day our urine should be relatively clear if it's too dark yellow we're not doing a good job of hydrating enough yeah how much of that is true um is alkaline water worthwhile for changing the alkalinity of my body I learned when I was in college and graduate school that the alkalinity of the different tissues in your body is very well controlled in

00:21:21 order to keep you alive and that you don't want it to shift too much or you can enter pretty horrible states of seizure vomiting and even death so tell me about hydration and woven into that if you would educate me on electrolytes and hydration because I think most often when people ingest electrolytes sure they could be ingesting salt tablets probably getting some electrolytes by the way electrolytes sodium magnesium potassium through their food I think most people think about drinking electrolytes so water and electrolytes I

00:21:53 think is a vitally important topic to kick this off with sure we can jump right into your alkaline water um while there's perhaps much to say about this uh we can maybe revisit this in another seven part series all on its own uh I would just say it this way there's probably a few things you should do before worrying about the alkalinity of your water and I'll I'll just leave it at that meaning the alkaline of the water is sort of irrelevant not that you won't go that far it's just it's probably remember we

00:22:23 sort of started off talking about 8020 M um well this would be in my like 991 in terms terms of like if we're really at the level of worrying about the pH of their your drinking fluid uh we have optimized so many other things uh that then we can talk about it but until we have nailed months and years of work on other things this is just not going to make much of an impact great then perhaps you could tell us about what volume of water we should be drinking when we should be drinking that water relative to training and just generally

00:22:55 and um yeah and anything else related to water and electrolytes that can improve mental Performance Physical performance and offset any you know ill effects I like the fact that you mentioned physical and mental performance because it's clear in both cases we hear that we need to drink more water and I can give you some numbers and I will in a second what we also need to recognize is there's this is hormesis we talked about hormesis a few episodes ago and this is the case right whether we talked about

00:23:22 food or hydration or I think I gave you the example of cyanide naturally occurring in your food hot water is same way so if you are under hydrated or dehydrated then there is a clear negative effect on your body and as I increase the level or improve the level of hydration things get better whether this are physical performance or whether this is mental performance in fact we know that a body weight reduction of as low as 2% via dehydration so imagine you're doing a about of exercise and you're sweating

00:23:49 and you lose 2% of your body weight that alone is enough to reduce accuracy in performance so the classic study we talk about here was in basketball players so shooting accuracy so free throw shooting I think is specifically what they looked at um significant reduction in performance with as little as 2% dehydration that that level you also see a significant increase in perception of difficulty of exercise and so only right at 2% again when I say 2% I mean percent body weight lost right that's what that

00:24:17 means you start getting the 3 four 5% dehydration you start having a significant reduction in blood volume and that's incredibly important for endurance um your blood becomes viscous it gets hard to pump through um and you're going to start having all kinds of issues so being dehydrated is again not only going to reduce performance but because of the mental aspect which we just walked through and neuromuscular issue you're going to lose accuracy you're going to lose total endurance performance and you're going to lose

00:24:45 speed and power so we have the Triad there no matter what you're interested in it's going to be harmed by being dehydrated that also is happening then if you're starting your program dehydrated so um if you're already 1% or so DEH hydrated maybe you're like a little under hydrated and you lose a little bit of sweat you've already hit that 2% and so we're starting to see reductions um in performance there the same happens on the other side of that hormetic curve so if you are optimally hydrated in some large window but you

00:25:13 start going past that we can start running into equal problems remember there is a there is a need for an optimal concentration of sodium and potassium and chloride between your

cell inside your cell and outside your cell these are electrolytes this is what we call osmolality and osmolality is really think of it like concentration and osmosis if you remember those terms so if we are trying to create a muscle contraction that requires an electrical gradient and so sodium and potassium specifically in magnesium calcium are

00:25:41 positively charged and chloride is negatively charged and we need to have a certain amount inside the cell and outside the cell so that the positives and the negatives are balanced appropriately um so that when we move one we change the voltage and we have in the case of a muscle contraction okay I just skimmed through a whole lot of physiology there to say if you then go mess with fluid only and you say if I were to give you a bis of you know 3 l of pure water right now you're going to dilute your blood and so

00:26:10 there's not going to be as many chemical uh there won't be as many electrical signals in there because you've taken the same amount of sodium potassium Etc and put it in a larger volume of pure water so that gradient is now changed that becomes a significant problem for contraction um I mean quite literally it can kill you this is what we call hyponatremia so nmia spelled na hypo being low hyponatremia if you actually go to the Periodic Chart na is what we Ed for sodium so hyper because the word

00:26:39 is nrii actually so that what that literally means is low sodium and you didn't get that from sweating out all your sodium you actually get hyponatremia from drinking in too much water so it's not that the total amount of sodium gets low it's the fact that the concentration gets low from excessive fluid intake so in the Extremes in fact if you look at the literature you'll see um anywhere between like 2 to 15% of people who finish endurance races are are into hyponatremia now that varies wildly if

00:27:05 you're doing Iron Man and Kona versus like you know the marathon in Denver in October right it's going to be totally different depending on weather conditions but these are all important um so while like death happens that is sort of extreme if you back up just a little bit you start seeing the same types of performance sacrements in fact the symptoms can be identical brain fog confusion performance uh irritation a GI distress and you think man these are symptoms of dehydration so then you

00:27:33 drink more water and you're just exacerbating the problem and I can actually um give you one little example of this we had an executive actually female CEO uh I'll say she's probably when her was in her early 40s and so she came to us and she thought man for sure she has some sort of gut problem going on because we hear a lot about kind of like gut health and how it affects everything and so she's just like I have brain fog and I've done all these things and I got blood work done and everything's fine like nothing's going

00:28:00 on I think I must have some sort of gut thinger going on whatever and it's okay and we just started going through her stuff and uh she was I think about 170 lbs plus or minus and she was consuming like 250 to 60 ounces of water a day that's a lot of water that's a ton of water and we were like holy what are you doing this for and she just like I that's sort of like my thing it was but she didn't realize it was more of like a nervous tick than it was anything else right she just like sip sip sip

00:28:25 sip water I'm like man how often do you go pee she's like yeah like every you know 30 minutes or something I'm like fantastic sleep problems focus and so she's smashing caffeine she was at like 8 cups of coffee a day which is also going to add to excretion of sodium totally right so it's like okay we don't really need to come in and run a sleep study on you we're just going to lower your water and she was like what we dropped her down to like 180 so basically an ounce per pound of body weight which is still high cuz she did

00:28:56 train 180 ounces correct yeah she does work out so she needed to replenish some stuff and we'll cover these numbers in a second instantaneously I mean like two days in she's like oh my God I haven't slept six or eight hours in years and then after that it was like basically tears coming back to us right my focus my brain fog is gone CU she's in a very high pressure job um it's like everything's coming back like now she was down to three or so cups of coffee a day blah blah blah like the whole thing digestion improved

00:29:23 all of it she was s like her only problem after all the analyses was she was just drinking way way too much water and adding more salt to her would not have solved the problem because she would have just had simply way too much fluid n system she was having all kinds of ADH problems and aldosterone like the whole thing and that that rolls into cortisol the whole like system gets goes into chaos so um it is important that you pay attention to hydration um even though as you sort of mentioned people

00:29:51 tend to just kind of like roll their eyes around it because if you're in the middle it's fine but if you're anywhere past not even the extreme extremes but just that first standard deviation away um you're going to have problems and you might be thinking adrenal fatigue you might be thinking your Testo like you're going to think all these things and you simply just haven't actually dialed in your hydration yeah um I think people sometimes roll their eyes at the discussion of hydration because it just

00:30:15 doesn't sound very sexy it's not like doesn't sound like a neurotransmitter or a hormone it sound like testosterone or estrogen or DHEA or um dopamine but it actually is all of

those things it sits at a level beneath all of those but not beneath on a hierarchy beneath in in terms of a foundation it's actually the without proper electrolyte balance and hydration none of the cells of the body can function and then I think people also hear that oh you know we are 70% water and somehow like that statistic

00:30:47 Alone um or that fact alone doesn't seem to uh stimulate any kind of action will take away it's like great you know uh like gravity also you know keeps us you know from jumping as high as we like you know what do I do and so I think um it's it's important that people understand that every cellular process in the body critically relies on having enough sodium magnesium potassium around and the the way that it's concentrated in fluid water is really the way that you allow every cell in your body to

00:31:19 function as well as it possibly could and respond to all the sorts of kind of quote unquote High Performance Tools that we're talking about the other thing I've observed many times over is that if people are ingesting too much water and also drinking a lot of caffeine and their electrolytes are low they get shaky and they actually can have anxiety like symptoms when people come into my lab to do studies on anxiety and fear we ask a few questions and um those questions include how much water they've

00:31:45 had that day also a sort of bizarre fact um but one that I think is worth mentioning is that when the bladder is full it stimulates a sort of anxiety if you ever had to urinate very badly and you're in the car or you can't urinate and then you get the door like that's talk about anxiety um and that's because there's a direct neural pathway from the bladder that registers the mechanos sensors how much stretch there is on the bladder that sends a signal to the brain stem alertness areas broadly speaking

00:32:13 Locus culus and others um that wake us up these are the when we're awake it makes us more awake and when we're asleep this is what wakes us up to urinate in the middle of the night yeah that's actually why you can use uh night urination as a a pretty good diagnostic of sleep disorders so if because of vasopressin right exactly what you're talking about uh if you're having sleep disorder issues and you're staying awake and uh vas op pressant gets taken off right an APN goes straight to the kidneys your

00:32:40 kidneys are supposed to be dormant basically at night you're not supposed to be filtering a lot of and producing a lot of urine at night um if that's happening and and say you you have any number of apne kicking on or anything going on vasal press keeps going keeps sending signal kidneys start filtering so if you're waking up and peeing multiple times a night that's called nocta that is a very very very good sign that either one of two things happen you one you have some sort of sleep disorder or two you're drinking outrageous

00:33:03 amounts of water and so that's actually a bit of a backwards cycle in now right because you're drinking way too much water you're waking up and peeing all night that's actually ruining your sleep and so we have seen this a number of times with our sleep company as we go in and it's just like you don't need any of this crap you just need to be properly hydrated alternatively if your hydration is sound and you're still waking up more than one time a night to pee on average then you almost well I shouldn't say

00:33:26 like that but there's a potential that you have some sort of sleep disorder or sleep condition going in so the rule of thumb on that is so we're here once or night once a night or so of urination is fine um if it is routinely or consistently more than two uh you need to make some adjustments start with hydration it's the simplest way right getting a full sleep study done just figure out hydration we we've had this happen a number of times where people want to get more health conscious and they just get they hear things like this

00:33:53 and they're like I got to get on my water and then they just start train wrecking their sleep and they're waking it up so if you're up multiple times and you're urinating and it is a large amount of urine for you and it is clear that's probably not sleep apnea induc nocta that's probably excessive hydration if you're waking up a bunch of times and it's fairly small amounts of urine then it's probably not the fluid issue it's probably the fact that the basal pressure is kicking your kidneys into gear so that's not a perfect

00:34:19 criteria but it's just like a quick little tool you can sort of use um that's actually one of the reasons why we measure almost always uh your body weight at night as well as in the morning so that that's like the combat sport in the UFC fighters boxers we call that your float so how much you floated overnight I like to know that number because I want to know as well your first morning void so when you wake up then you went to bed at 200 lb you woke up the next morning at 195 it's like oh you floated five pounds

00:34:47 did you pee last night yeah yeah three times interesting another case you woke up you went to bed at 200 lb you wake up at should have a certain amount of fluid that you're just respirating out as you're breathing throughout your nose throughout night ideally uh guaranteed you're going to wake up what was your urine like oh yeah a little bit pretty dark like shocker you're dehydrated so you can kind of look at numbers like that a general float is something like a pound to two pounds for the 170 plus

00:35:16 pound person as you scale up that number can go up a little bit you can kind of use these to triage a little bit about what's going on um with this kind of combination everything is

everything right so it's like it's not just about one system so you're going to pay attention you can also look well I don't know if you want to jump into it we can but there's a whole bunch of ways I I can teach you to diagnose hydration and then maybe we can start there and then we can talk about hydration numbers yes

00:35:38 I'd love to talk about diagnostics for hydration overhydration dehydration to start off would you be willing to give us some numbers how much water should we be drinking the classic rule here and you're making me do what I hate right I want to give all the caveats first but I'll go straight to your number half an ounce per pound of body weight is a rough rule so if you weigh again 200 lb that would mean you drink 100 ounces of water a day most water bottles are like 12 to 20 ounces something like that so you know you end

00:36:09 up drinking six of those or so a day kind of like plus or minus which is not that unreasonable um this does depend on a number of factors which I could go over but that is a rough starting place the only other thing to add to that is that does not account for exercise induced water loss Ora or anything like that so that's assuming just like basil daily needs if you are exercising or sweating at all for any reasons or work related so um folks that work outside or in the Heat or a human environment this these

00:36:41 numbers all change and you can slide this scale up but you generally want to drink about 125% of the fluids you've lost during that physical activity back and how much do you lose per hour of exercise it that number range is between 1 to 5 lbs depending on the person it can even be higher with some of our athletes like I can think of a number of NFL players right now it's not uncommon for those guys to do eight or nine pounds even not even like crazy circumstances if it's August and we're in Jacksonville it's

00:37:10 not wild for us those guys to go 9 10 pounds but what about the typical person who goes to a air conditioned gym or goes out for a run on a day that is somewhere between let's say 55 degrees fenit and 85 degrees F you're probably looking at like a pound got it it's not extremely high if you are are totally soaked might be like a pound and a half to two lbs if you're like come back and like your pits are a little sweaty and there's a little bit of water kind of on your neckline or it's probably like a

00:37:39 more like a pound or so so in that case you might drink back a pound and a half of water okay so just to review these numbers to make sure that I'm on the correct page here a half an ounce of fluid per pound of body weight is a a sort of a foundation for hydration and then you want to replace 125% of the fluid lost during exercise and exercise varies where exercises done varies whether or not people are wearing uniforms or helmets is going to impact how much fluid they lose Etc in a very hot environment that the

00:38:16 amount of fluid lost can be anywhere from you know 1 to five maybe even 10 pounds easy per hour of hard hard exertion for most exercise done in conditions of 55 degrees Fahrenheit to 70 degrees Fahrenheit 85 degrees Fahrenheit done with some degree of effort one might lose a pound or two pounds of water super easy way to find out all you have to do is weigh yourself naked go do your workout come back in dry off weigh yourself naked that'll tell you exactly what you lost so if you were 160 pounds you come back out you weigh

00:38:49 you're 158 you lost two pounds drink back 2 half pounds of water you're good so that is uh honestly it's like fairly gold standard for identifying you can actually buy a whole bunch of technology for this and they are using the exact same equation which is your body weight when you were there now if you do that though you do need to account for any fluid you drank during the workout sure because that then offsets it simple but I think important question we're talking about a half an ounce of fluid per pound

00:39:17 of body weight does that include things like coffee tea soda pre-workout drinks mid-workout drinks uh mate Macho whatever the you know there's a yerba mate there's a million things out there um or just water any fluid for the most part is going to count and is it true that fluids that contain caffeine generally cause us to secrete sodium yeah okay so do you recommend including electrolyte powder or a small pinch of sodium or any number of other supplement type electrolytes that can replace that sodium magnesium and

00:39:55 potassium a couple things we have to pay attention to to accurately answer that question what you also sort of asked about you may have not realized is does caffeine actually enhance dehydration uh which is not really what you asked but it's probably a lot of people thought that as well so caffeine can but coffee doesn't necessarily do that because remember you're going testing that with fluid and so we used to say that all the time how coffee dehydrates you it doesn't it might make your urine yellow it certainly gives off

00:40:24 an odor in your urine but in general coffee will not do that because your if you were to now be taking caffeine pills alone now there is a bit of a diuretic effect there and so you're going to urinate how much maybe not enough for you to be really concerned with especially when you balance that against the ergogenic effects and benefits of caffeine it's not something we are concerned about second part of your question do you need to then offset the loss of sodium I'm not super concerned about the amount of

00:40:52 sodium lost to caffeine I am more concerned about simply the amount of sodium being correct because of the bigger circumstances like how much is actually in your system and

how much you lost in the training session so it's not the caffeine that I care about that much relative to you know if you lost three grams of sodium because of the training and you added another few milligrams because of the caffeine I don't really care or or didn't I'm glad you brought up the difference between a substance like

00:41:18 caffeine and the vehicle it's contained in like coffee this is all really important and it also raises a question about individual differences in sweating ability and I call it sweating ability because uh I have a good friend I've known for ages really um actually work with him in my laboratory uh as well and he's one of these people that the moment he starts any physical activity it's like a flood warning right he just soaks through clothing it's just the sweating adaptation is is exceedingly robust in

00:41:48 him other people less so so is it true that sweating in our ability to dump heat through it by loss of water is something that um we tend to vary on and that also that we can build up that capacity I know a number of people are probably thinking ew gross why would I want to sweat more but there's actually a huge advantage to be able to dump body heat during exertion because body heat in some ways sets the cap for performance in lot many many ways including mental performance our ability to stay alert often is enhanced by it

00:42:16 being cold and of course we all want to warm up properly but um in terms of loss of fluid through sweating is there a way to easily bin ourselves into kind of a a low sweater medium sweater um heavy sweater that sounds like an article of clothing but in any case you know what I'm you know man another a lot to say here we should wish we had a whole series on this um listen if we have to go 17 hours we can do it just everybody hydrate well I think we've shown the listeners uh that is a real threat

00:42:47 that's a very real threat podcasting to failure you don't have to do every set in the gym to failure but here we are attempting a podcast failure in it in all seriousness um what what is the role of sweating ability and is this something that any of us should care about or train for or pay attention to or is this just kind of getting into the Arcane number one you can train your ability to sweat this is important for heat acclimation and why that matters when you sweat that actually is not what

00:43:15 regulates your temperature what you want to have happen is the fluid to hit your skin and that to be evaporated that's the actual mechanism so in fact um if you stop sweating and like you can guarantee within a short amount of time you're going to be done moving oh very interesting I hope people heard that and really are are highlighting that in their mind that sweating is a process of bringing fluid from your body onto the surface of your skin and then the heat dumping aspect of sweating is the

00:43:43 evaporation of that off off your body which brings to mind all sorts of ideas about how to dress during exercise Etc but what you said is that if you are not sweating enough you are limiting your output capacity so it's not just about having fluid to sweat y it's also about being able to sweat and being uh Dressed appropriately to allow that sweat to move uh to evaporate off your body yep and heat acclimation training is as simple as it sounds so just practice it more so uh if you're going into a

00:44:13 process where you either need to be in a hot environment or you need to improve your sweat rate you just need to practice sweating and your body will get best to that practice the sauna practice a Jacuzzi just get in those things and you will uh improve your ability to do that now there is a huge genetic component um I have one individual actually a UFC fighter I've been working with and I don't mind mentioning his name he'll give me full permission Scott Holzman uh many many years um he's actually um fighting right now actually

00:44:40 today he'll be going he is like he he is like you described like buckets and buckets and buckets of fluids come off this guy when he's tying his shoes like he just goes right like and know we've we've improved that I actually sweat too much we worked on that a lot early in his career and we we got some improvements down to get him to hold on to to fluids better that being said I've worked with other individuals in his weight category and it's the opposite right so we can have them literally do the exact same training session together

00:45:05 and Scott will dump six pounds and and other folks at his size will dump two two and a half so there's a genetic component that is just there and you don't need to worry about it there um so can you identify if you are a heavy salt sweater or not well you have a whole bunch of routes for this number one is you can use the old free um cost free test of just looking at your clothing and if you're seeing that white residue all over it so youve You' all have the friend who probably wears that same B

00:45:31 baseball hat that they've had for eight years if it is covered in the white junk all over the place um that's a sign of a higher salt sweater if the opposite happens and it's like you can pull their clothing back and there's just nothing there and they maybe a little bit of a lower salt sweater um you can also use any number of hydration tests I know that there is some coming out in the market very very soon that can give you theoretically real time um measurements just like a CGM would be although I

00:46:02 haven't seen any data on if those are accurate or not I haven't used one yet but there are number that are out super cheap you know 10 15 20 bucks all the way up to a couple hundred

dollars you can buy these patches put them on you and get a reasonably close estimate um and again if those things are five or 10 or 20% off I don't know have to see independent data come out first but even if they are you're not worried about the specific milligrams right whether you sweat out you know 1,250 milligrams in a

00:46:28 workout or if it's 1340 it doesn't really matter you're trying to look for big big numbers right are you losing 500 milligrams using three and a half grams where you're at so those things will get you in a ballpark to do exactly what you decide am I high medium or low um and there's a lot of them that that I've used in the past so that that's another way to go about it um then what you want to do is probably match your electrolyte intake to something close to what you sweat that's the ideal scenario um you

00:46:55 can get a lot of information about hydration from blood um you can look at like acute markers of dehydration like hemoglobin hematocrit uh if your like if your hemoglobin is like 15 plus it's funny we've talked about this in a few episodes before but I see that and I'm like man that dude's super fit that's like a 15 uh for hemogo would be pretty high 14 or so would be pretty good for a female that's also the exact same thing as a sign of acute dehydration um so hematocrit same thing if you're north of

00:47:22 50% you're probably dehydrated so you can get a lot there are also though a lot of biomarkers that can tell you more about chronic dehydration so you can run through those things as well so a good blood chemistry test can tell you a lot and you can actually get some insights in your sodium and potassium albumin is another fantastic way to measure longer term hydration status another one of these amazing globulins that we've sort of talked a lot about so you can do all those things you can also simply

00:47:47 measure the body weight pre-imposed and use a sweat patch or not and use the the Freer version of your clothing test and get a rough idea of where you're getting it from so those are good places to start um I want to go back though and make sure I wasn't over terrifying the audience too much on a s piece if you're performing a type of training or exercise or sport in which you're not losing more than 2% of your body weight you don't need to be overly concerned about hydrating in the sport and so we

00:48:17 can actually get into to um some equations for how much water to drink during training right now but if you if you're again losing less than that it's not critical you can have some fluids like makes you feel better but you're not going to be experiencing tremendous amounts of performance sacraments if you're you know again out playing a baseball game and it's 50 degrees out you're fine um you can drink some water but that's not going to be compromising performance or recovery so we can actually then if you'd like I can go

00:48:43 through the three-step system for optimizing hydration but um those are I I want to make sure I planted that flag so people aren't just terrified that they got to be guzzling down water if they're you know going to their physical therapist for some stretching that's probably not super important I'd like to take a brief break and acknowledge our sponsor athletic greens athletic greens is a vitamin mineral probiotic and adaptogen drink designed to help you meet all of your foundational nutritional needs I've been taking

00:49:09 athletic greens daily since 2012 so I'm delighted that they are sponsor of this podcast the reason I started taking athletic greens and the reason I still take athletic greens once or twice a day is that it helps me meet all of my foundational nutritional needs that is it covers my vitamins my minerals and the probiotics are especially important to me athletic greens also contains adaptogens which are critical for recovering from stress from exercise from work or just general life if you'd like to try athletic greens you can go

00:49:35 to athletic greens.com huberman to claim a special offer they'll give you five free travel packs and they'll give you a year supply of vitamin D3 K2 again if you'd like to try athletic greens go to athletic greens.com huberman to claim the special offer I would love for you to tell us what I refer to as the Galpin equation understanding of course that you did not name the Galpin equation listen folks scientists can have things named after them but in general it's not uh reflective of healthy psychology if

00:50:05 they name things after themselves correct sometimes yes neuro anatomists used to do that but in any case Dr Andy Galpin did not name the Galpin equation after himself I named it after him and the Galpin equation for how much fluid to ingest during exercise is you want to take your body weight in pounds and divide that by 30 and you want to consume that number which would be in ounces about every 15 to 20 minutes so in the example of you being 200 pound you would take 200 divided 30 which is let's just call that number

00:50:38 seven to be close which means you would consume about 7 ounces of water every 15 or 20 minutes or so okay now as a little bit of a point while I also did not name it I also didn't do the research it's important to point out that other scientist figured these things out I just read their papers and made that derivation of their equation to make it a little bit easier for those folks who do not work on the metric system okay a couple of things first of all I'm not 200 lb but it doesn't matter how much I

00:51:03 weigh because the point is that the listener correct should take their body weight in pounds divided by 30 and just that number of ounces in fluid every 15 minutes and then for those

out there outside the US that are accustomed to thinking in milliliters and liters not ounces and kilograms not pounds what is the Galpin equation in the metric system this would be 2 milliliters per kilogram which again if you were uh let's say 200 lb that's going to be something roughly like we'll call it 90 kilos and so if you did 2

00:51:37 Millers per kilo you'd be something like 180 milliliters of fluid again every 15 or 20 minutes great and how should people ingest that fluid and of course I would imagine it's through their mouth um I would hope I hope there are other orices that that it might suffice but let's not go there they're drinking that water consistently or is it every 15 minutes they Slug it back does it matter okay yeah that's very good a handful of things in general when you talk hydration the slower and steady you can

00:52:08 go the better in fact the reason this this 2 Millers per kilogram uh number came out is because a number of Trials were run when they looked at that every 15 minutes just one bolus of it you know um in different derivations and it is pretty clear that the slower Pace one could do it the better so whether you're doing it every 10 minutes or 15 or 20 minutes the reason we actually give that Gap is because you have to be also offset a little bit of Gus stress in fact like kind of the the four golden

00:52:36 rules of recovery if you will um we use sort of three Rs you need to rebuild rehydrate and replenish what that really means is you need to have a continuous glucose stream you need to have a continuous amino acid stream you need to hydrate and you need to do all one two and three without disturbing your gut too much and so in this particular case um it was sort of found that we can hit that level in general and be just fine for most people so I mean a little bit of context the example we gave there in both cases it's

00:53:07 something like 6 to 7 ounces for 15 or 20 minutes if you think about that there's 16 ounces in a pound and most water bottles like if you go buy a water bottle at a store here it's they generally come in like 16 ounce bottles is so six or seven ounces is really like a third of a water bottle maybe every 15 or 20 or so minutes so it's not some egregious amount of water that you have to slime down now that is influenced heavily by how hydrated you started the session with so how hydrated you came in

00:53:38 external factors like heat humidity temperature things like that but that gives you a rough idea um that again and these are numbers that you would need to consume to optimize performance at the end of that then is when you would look to see how much I lost like we talked about earlier and then add back that 125% taking into account how much fluid you ingested so if you're 200 lb and you drank a total of say a pound of water during the training and you started off at 200 and you finished at 198 you actually lost three pounds not

00:54:17 two PBS because you lost three you drank one during it so your final net number is two so now you don't you really need to drink back 125% of that remaining 2 lbs 2 and a half PB something like that um these numbers especially that 125 are they're just rough guidelines some actually papers suggest it's all the way up to 150% um so it's just like an idea don't measure out whether you need 5.5 ounces or 6.2 ounces like it just sort of gives you an idea of where to start all right a few sips every 15 or 20 minutes

00:54:49 is close enough I've actually started using uh the Galpin equation to determine how much fluid I need for mental work given the now robust data that are out there on the relationship between hydration and mental work it's um been very effective for me and again there are peer-reviewed studies that that support the idea that hydration is important for uh proper mental Clarity and energy and focus and that even being slightly dehydrated can disrupt that but if one is drinking so much water that they're frequently going to the restroom

00:55:22 and can't comfortably uh focus on the work they're doing that's also an issue so so um that's very helpful what are the three most critical features of hydration and then I'd like to move on to um some of the more particulars about supplementation and nutrition three parts start hydrated maintain hydration throughout part three is hydrate post to fix it okay we gave you the half ounce per pound of body weight equation so you start the training hydrated we gave you the you know 2 milliliters per kilogram

00:55:55 SL body weight divided by 30 to stay hydrated and we gave you the 125% um but I can actually just give you sort of I'm giving you another list here I'm sorry but it is my five-step cheater guide for optimizing hydration for performance all right step number one drink a lot of water first thing in the morning this gets everything kickstarted get you going it also saves you from having to drink a bunch of water at night which is then going to compromise your sleep what's a lot depending on how big you are the general thing I'll tell

00:56:24 people is like one of the very first things you do throughout your day you wake up go to the bathroom as you're consuming your sunlight consume water this is maybe chugging a full glass it's honestly what I do it's not the best route but I'll just get that going 16 o 16 ounces or so is great it's fine if you're larger um you know I'm I'm 165 to 70 lb depending on what's going on maybe a little higher sometimes if you're 225 lbs maybe that number is 30 o right so you just sort of scale up and down and

00:56:53 the only reason I say a lot is it just depends on on what you're doing and I also should clarify I don't really literally mean chug just like Zips because the faster you drink water the

faster it's going to expand blood volume the faster it expands blood volume the faster you get rid of it um I don't think a lot of people will know that yeah this is maybe this is clarifying this is also we sort of talked about earlier if you drink too much water you'll dilute the system well if you have a diluted system your body's first

00:57:18 reaction is to rid of water to bring total blood volume down right remember if you were to go to a doctor and they looked at your total blood volume and they're like man you're at 5 and a half liters you're going to be like holy crap you're going to be put on a diuretic because you don't want to have a heart attack and have blood pressure I I wonder if people are drinking a 16 oun glass of water or other fluid all at once before going to sleep and that's why they're waking up in the middle of the night totally given what you just

00:57:43 said probably a better um protocol would be to sip on a glass of water in the final hour or 2 hours before sleep you generally the number we say is 3 hours in the 3 hours preceding sleep you want to basically fluid intake to sipping as needed I think that's I'm going to start that tonight yeah because I wake up generally once per night to use the bathroom and I do drink some fluids before I go to sleep mostly because I'm pretty thirsty at that time yeah um but I'm going to start sipping that water in

00:58:13 the uh three hours heading into sleep yeah so you can actually pay attention to is um to go back this is actually I love doing this stuff but if you're waking up at night and you have a very dry mouth m not for me all right because it can be one of two things you might actually be dehydrated and so then the mistake people make is they like man my mouth is so dry I keep getting up to drink water at night that makes you then pee too much what that also indicates is probably your mouth breathing so a lot

00:58:42 of ways to fix people waking up and urinating too much at night is to tape your mouth and or use a a dilator over your nose and then what happens is you don't feel like you have a dry mouth so you don't get up to consume any extra water throughout the night so that actually reduces your your fluid intake so you don't have the problem of actually now having too much fluid to do it and so it's another reasons why mouth taping can really really help um I if you are having those issues U and or snoring those are not benign that's a

00:59:10 really like you really should get some work on those um something you're you're not sleeping very well is the way I'll say it it's doesn't doesn't necessarily mean something life-threatening but it's not a good thing so um you're going to run kind of your triaging things back and forth so if you're like I'm waking up to pee a lot by my m isn't thirsty okay great then you may actually have just a water consumption issue if it is my mouth is dry but I'm actually waking up and I'm having these large urinations

00:59:38 then you're not actually dehydrated you're just breathing through your mouth if you're waking up and your mouth is dry and there's not a lot of pee there then you actually might actually legitimately be under hydrated so a little bit of a game you can play there well that's super informative I think that um the point alone that gulping a bunch of water all at once is going to cause you to need to excrete that water soon after um is a really important point also for people that are going to I don't know give a talk or um you don't

01:00:11 want to have to get up to use the restroom you have to sit through a long meeting um clearly I'm violating all these rules up until right now I've been you know not I I sort of Follow The Seagull approach to uh to consuming fluids just in um enormous volumes I'm going to start sipping um fluids instead um what are some of the other rules of hydration so you're going to wake up you're going to start your day and start hydrated so you know you're you're consuming a larger percentage of your water earlier

01:00:38 in the day then you get all the performance enhancing effects of water and you don't have to worry about it compromising your sleep so that's step number one also now you're going to start your session closer to hydration all right great number two eat mostly real Whole Foods why interesting what you may or not have thought about is a huge determinant of your hydration status is your food choices uh if you look at different foods uh for example most fruit um watermelon watermelon is like 95 plus%

01:01:10 water right fantastic Source also by the way since we're here it is not extremely high in carbohydrate it's not extremely high in sugar it is by percentage but since it is almost exclusively water you're eating uh it is not something that is extremely dangerous in terms of sugar um I there alone probably all the things we've talked about in the six six episodes uh that comment right there will probably blow the internet to pieces and I'll probably get hate mail for life for it but from people throwing

01:01:36 water throwing watermelons yeah oh my gosh well I don't think the point is that sugar is necessarily bad I think the point is that for most people they're ingesting too much sugar most people yeah um and it it's interesting often times the people who are justifying the ingestion of sugar are exactly the kind of people that should not ingest so much sugar so there's a little bit of a user the point here is if you're eating whole real food this is like now we're kind of splitting hairs about those things so so

01:02:03 morning hydration cons real yeah now important Point here if you compare it to other Foods um like actually meat is is a very high percentage of fluid depending on how well or long

you've cooked it you will reduce remember you said earlier over 70% water right so if you're eating meat you're getting actually a big chunk of water as you cook it of course you lose some of that but meat can be like I wouldn't call it a hydrating food item but it is not as low as something like a biscuit which can be actually like 10% water that's

01:02:33 why it's like dry and dense which doesn't mean it's bad for you but there if you're eating highly processed foods almost by association that means they've been dehydrated or Pally right so you're just getting less total fluid intake in addition they have also been highly salted in general right so now we're in this position where we're under hydrated and highly salted bad spot if you now switch over to mostly again just mostly whole real foodish whatever that means to you then your hydration is going to

01:03:01 Skyrocket you're going to have a lot so you're eating a ton of food in fact it should be a large percentage of the fluid intake you have actually should be coming from your food and you shouldn't have to be smashing water bottles after water bottle all day in that case though you do need to add salt back so we do see this a lot with people who try to make a transition from maybe a suboptimal Nutritional Lifestyle and they they give up a little bit of the processed food and they come over and they start having problems because

01:03:24 they're not actually consuming enough salt so add that back easy way to do that you can use electrolytes and we could talk about those numbers if you want if you just salt your food that you're making you know to taste that's going to get most people in a in a pretty good spot so start hydrated consume hydrating Foods step number two step number three you want to preh hydrate if you know you're going to do a workout session and it's going to be hot and long or one of those things um you want to look for that half a

01:03:54 pound uh per body weight of ounces so that's the number we're looking for to start our hydration session we do that we're pretty much taken care of and then like I said adjust depending on lifestyle humidity and and other factors like that um you can use what is called the what system W I think Bob Ki who's done a ton of research in this area if you want to read more look up his research um it is simply weight urine and thirst so in other words check your body weight look at your urine color and engage your

01:04:26 thirst and actually you can use those three things and those uh can significantly predict actual hydration status independent of actually measuring osmol or or anything like that so those three metrics alone are a pretty good indicator of where you're at so you're going to have that normal amount of water plus or minus if you miss that number for whatever reason you get distracted the number we typically tell people is like something like 400 to 500 milliliters of water uh in the hour preceding the training all right so

01:04:57 that's like 13 to 20 ounces so like you know you're going to go out at 3:00 it's 2:00 and you realize oh man I have not drinking much water today um you don't need to go smash tons and tons and tons just look for something like that you know call it a bottle of water if you will um if that's not enough if you're in a really tough spot you can do more like uh five to eight ounces 15 or 20 minutes before exercise you want to be really careful about drinking a bunch of water like in the seconds before exercise because you're

01:05:29 just going to feel a whole bunch of water bouncing up and down in your stomach and nobody likes that so 1 to 300 milliliters 15 or so 20 minutes before that assumes you're in this like 185 pound range is again if you're talking people of much larger size you may need to increase those values accordingly if you do all that then you use the Galpin equation for your intra workout hydration and you're in a pretty good spot um what you want to consume in that is what I call Sweat what I mean by that is you don't

01:06:02 actually want to necessarily consume water only during a workout you want to consume something that is isoosmotic to your blood so something that is the same concentration that you lost in your sweat so if you've done a sweat test you would then drink a fluid that is of the same osmolality um the short version of that some in the neighborhood of 200 to 400 milligram of sodium most electrolytes uh products are going to be something like that now I know element is is 1,000 milligrams it's a lot higher

01:06:38 but most products now that you're going to find are 250 to 400 milligrams and they're typically in the like two to maybe up to 3 to one sodium to potassium range right coconut water is actually cool it's like basically the opposite like a cup of coconut water I think has something like 200 milligrams of sodium but like 600 milligrams of potassium so um like total spoiler alert but well we use coconut water a lot of hydration just add a little pinch of salt because that'll bring the sodium

01:07:06 way back up yeah one note about sodium um obviously people who have prehypertension or hypertension want to be careful with their sodium intake um anytime I've suggested that people might consider ingesting more sodium you know sort of it's like putting a Target on your back and yet the data are pretty good showing that if people are not getting enough sodium their mental Clarity their focus their uh mental stamina their physical stamina really suffers and then people argue well most of us are getting too much

01:07:37 salt that often is true for people that are eating a lot of processed foods and not training and not training but for many uh people who are already sort of healthc conscious who are

training they're largely consuming or I should say they're consuming largely nonprocessed or minimally processed C foods and especially for folks who are not ingesting many carbohydrates and are consuming caffeine totally you know a lot of people don't know that carbohydrates hold water um and that makes it sound bad it's not necessarily

01:08:09 that you know you're going to get subcutaneous swelling of your body it's Rec it's it's bringing water into your system and it holds water so when you drop carbohydrate starches in particular you urinate a lot more and when you drink caffeine you also urinate a lot more as as you pointed out earlier so you start combining a few things like slightly lower carbohydrate or low carbohydrate eating really quote unquote clean you're not getting a lot of salt in your food and drinking caffeine and then exercising and then pretty soon

01:08:37 those numbers that come along with um you know a gram of sodium in your electrolyte drink are not all that outrageous and what you find is people feel much much better when they're getting enough sodium and of course I should um say that there's no reason why someone has to ingest a supplement like element or something there are plenty of other ways to bring sodium into your system you use a pinch of pink salt or Himalayan salt or sea salt or even just table salt in water or just making sure that you're salting your

01:09:05 food enough and I think that there too salt appetite and salt taste is a pretty good guide if you taste something and it feel it tastes really salty to you that's an indication that either it's really salty or your salt stores are kind of tapped off you're okay whereas if you're craving salt and you and you're thinking gosh I really want to put salt on this already salty thing not necessarily but often times that means that you are salt deficient so salt appetite is a pretty hardwired set of neural circuits and hormones and I think

01:09:35 uh we would all be wise to learn to tap into the our kind of intuition about salt intake but of course also to measure your blood pressure Etc yeah of course if you think you have some sort of contraindication there that work with a medical specialist without without question um those situations you laid out though were very real a lot of people are living like that and so it's important for those folks to understand if you are going through symptoms fatigue um lack of focus cognitive function performance isn't there then

01:10:01 hey like you may be UND salted and again actually a good amount of blood chemistry work can unravel that a lot and it can sort of tell you if you're running out of whack there are number of folks who are extremely sensitive to sodium in terms of health risk and that that is a real thing again work with your um individual folks on that I don't work with anyone for disease treatment or management at all I've said that probably for times I'll say it six more times um I only take people who are healthy and try to make them perform at

01:10:30 their best possible level so it's actually funny to mention that because I was going to give people my recommendation for sodium intake in general throughout the day and then I decided I'm not going to say that because all it's going to do is make all the rest of the people who aren't coming to come after me for the watermelon comment come after me for that so I'll by the end of today's episode the goal is that there everyone's coming after you but also that everyone has learned something of value you've already um

01:10:51 given us uh tremendous uh insights and actionable information information on Creatine and hydration and along those lines i' I'd love for you to tell us about some of the things that we can do with supplementation in order to enhance training by taking certain things before we train and I also have the question of how long before training should we start thinking about supplying nutrients and supplements for the training session I'm not sure I actually finished my five or maybe I wasn't clear enough about the

01:11:23 last one so I just want to tie that that bow and then we'll go next one yeah no it was probably my fault so that uh in addition to the Galpin equation in terms of amount I Amic recommended a you know roughly 3 to one sodium to potassium recommendation and I gave you some rough numbers for things to like that I actually in all honesty use probably six to 10 different electrolyte companies depending on the situation some of them are really good in the case again like element that's nice about that is

01:11:52 there's no carbohydrate however the downside is there's no carbohydrate so some sometimes I want carbohydrates in the training because as you mentioned there's significant evidence going back actually several decades on the benefit of carbohydrate during exercise so if you're in a situation uh where you're trying to again maximize actual exercise performance you especially if it is either long duration so more than two hours or extremely high intensity and this has to be well north of 100% of your V2 Max in that situation as we

01:12:22 talked about in the endurance episode you can actually start having a decrement in performance because of a drop of muscle glycogen uh G glycogen can start coming down if that's the case augmenting with the carbohydrates during the training that is going to enhance performance it's going to do what we call spare the liver and it's going to keep my second rule of my four which is maintain glucose ingestion it's going to keep that going in general what you're going to find is the number is like a 5

01:12:50 to 9% glucose concentration in your fluid which turns out to be like exactly the number that most sports drinks have as well as I think that's pretty much exactly what coconut

water is the downside of sports drinks since we're here is they actually tend to be undersalted and so that they don't provide enough of them if you look at the numbers they're going to say something like 60 to 100 gram of carbohydrate per hour is the Target and now if you're using the sort of gallin equation and you're splitting that up

01:13:17 into 15 uh minute intervals it's something again like 20 or so grams of carbs per 15 to 20 minutes if you're doing again an hourong plus training valow so admittedly 100 grams uh is a bit much for some folks depending on your size so I would recommend starting in that uh 60 gram or so range again per hour total is what you want to get to and only in the situation in which muscle glycogen depletion is becoming a limiting factor to Performance so the other benefit of that is as you mentioned that actually drives water

01:13:51 into the cell and so you're going to be in that nice sweet lot of you're actually keeping glucose going which is going to enhance performance and you're helping hydration at the same time so the other little part that's important to pay attention to here is the type of carbohydrate matters um so you can use actually a whole combination of things called resistant starches which I will use for a long bouts of exercise but in the middle of the workout you're going to want to focus on glucose and fructose

01:14:18 mostly glucose typically at least a two or 3 to1 ratio of glucose to fructose and the reason is those actually get into tissue through separate Transporters and so what happens is once the glucose Transporters get full you can't bring anything else in however since fructose comes in a separate route you can maximize total carbohydrate intake by using two different unique forms there there's a lot of ways you can do this um but this is where the momentus fuel product is is like specifically has that exactly in it so

01:14:49 it's fantastic um you can use food no problem you can use a combination of things like honey and and different easily uh absorbable and usable and things you can actually like maybe put in a drink um to get away with so there's lots of routes for it but you want to look in that that sort of combination uh of 5 to 9% roughly glucose for there so you do need to train your gut so do not do anything and there's a generally A good rule do not do anything in your competition that you've never done in

01:15:20 practice so try these food items try these amounts the carbohydrate numbers try the sodium numbers try the total amount of water start low you can always increase what you don't want to do is have to run out during the middle of your spin class and Sprint to the bathroom and hope nobody's in your way uh which uh in the lab we've seen we'll just say accidents like that occur more than once so um just be careful of your stomach I'd like to take a brief break to acknowledge our sponsor insid tracker

01:15:49 inside tracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate and long-term health and well-being can only be analyzed from a quality blood test one issue with a lot of blood tests and DNA tests out there however is that you get information back about various

01:16:12 levels of lipids and hormones and metabolic factors Etc but you don't know what to do with that information inside tracker makes knowing what to do with all that information exceedingly easy they have a personalized platform that lets you see what your specific number numerers are of course but then also what sorts of Behavioral dos and don'ts what sorts of nutritional changes what sorts of supplementation would allow you to bring those levels into the ranges that are optimal for you if you'd like to try

01:16:37 insid tracker you can visit insidetracker.com huberman to get 20% off any of insidetracker's plans again that's insidetracker.com huberman to get 20% off I realized I jumped the gun a little bit asking you about supplementation for before during and after a workout um because what I neglected to ask about was training in the fasted State this is something that we talked about in an earlier episode but I think it's worth highlighting now um Sometimes the best way to supplement if you will a workout

01:17:05 or pre-workout is ingesting nothing I I'm one of these people I actually prefer to do my weight training somewhere between 7 and 8: a.m. each morning sometimes a little earlier sometimes a little bit later I drink fluid water and I do ingest caffeine prior to those uh training days um on days when I don't train I do as I often recommend uh people do delay my caffeine intake 90 to 120 minutes after waking but in any event it's water and caffeine yate or coffee or some sort of stimulant for weight training workouts and

01:17:40 generally not for cardiovascular training workouts although sometimes yes so I'm training fasted that said I'm ingesting carbohydrate the night before to make sure that my I have glycogen stores that are topped off and uh so it's fasted but with that caveat what are your thoughts on training fasted and what I just described is fasted overnight but some people are training in the afternoon and they may opt to not eat anything in the you know two to four hours prior to training or maybe even longer I personally find that caffeine

01:18:14 hits my system a lot better when I'm fasted better meaning it just seems to have more of a potent effect there are some reasons for that um and of course we dissuade people from

ingesting Caff too late in the day cuz you'll disrupt sleep so I'm not saying fast for 3 hours then drink caffeine but who knows maybe that's in your protocol the simple version of this question is what are your thoughts on training fasted and if people are going to train fasted how should they modulate their fluid intake

01:18:43 if at all what happens with exercise in the endurance and Metabolism episode we walk through in the fact that no matter what you're using for fuel carbohydrates or fat or even um other potential sources the end product of all of those is ATP CO₂ and water right so you're trying to make ATP that is the fuel for exercise now ATP is a Denine triphosphate so one two three phosphates on top of an adenosine well what you may have not put together is if you hydrolyze ATP and you break off one of those phosphates you now have ADP if

01:19:18 you do it again you have a Denine monophosphate if you do it one more time now you just have adenosine and if you have then therefore run through a lot of exercise burned a lot of energy you have increase the amount of adenosine that's floating around now if you have a high concentration of adenosine what's that going to make you want to do that's going to bind to certain receptors and we know when those receptors get bound to you fall asleep Bingo caffeine will competitively bind to those receptors

01:19:51 therefore that's why caffeine stops you from feeling like you want to go to sleep right so we have a very clear relationship between exercise fuel in fact if you look at the literature there's a pretty clear relationship between the more caloric expenditure in different sports and the higher amount of hours needed for sleep so there is a nice tie between how hard you're exercising how much energy you're burning how much you need to sleep stimulant which brings us all the way back to your question of fueling so do I

01:20:20 need a fuel prior to my exercise bout if you're going to be limited in your exercise bout by Fuel then fueling is necessary one way or the other if it is a type of training that is not then it's not going to matter and so the examples we gave uh if you're doing if you're going to go do a 30-second bout of maximal exertion and you're going to do it one time you don't need to worry about fueling at all or eating within your workout CU it's only 30 seconds yeah you get 30 seconds you don't need to worry

01:20:50 about hydration post exercise you don't need to worry about recovery total energy expenditure was nothing uh if you're going to go um you know you're going to go practice you're going to go to the driving range and practice your golf swing you don't need to worry about it the total amount of energy expenditure is just not high in fact in that case you might want to keep it somewhat low because you want to keep blood glucose fairly even and you don't want to bring it in the system you certainly wouldn't want to use

01:21:12 stimulants right because you may get over exerted inside in all of these things we probably should have started off our conversation with this in terms of macronutrients the total amount throughout the day is more important generally than the timing of them which is why you can do things like have a bunch of carbohydrate at night not eat the next morning and lift and be just fine it doesn't matter that you didn't have them in a few hours before your muscle glycogen is topped off your liver is glycogen is topped off you're

01:21:43 absolutely fine you have plenty of fuel even if you wait a few more hours in fact even if you were to do conditioning you're probably fine I have plenty of athletes that prefer to do many of their training sessions faster the morning for personal reasons not because it enhances performance but if it doesn't enhance or uh harm it then and it's a personal preference thing fine if you're going to go do a session though where you're going to be really concerned with muscle glycogen depletion and again you can go

01:22:09 back that episode to learn of different types uh when those thresholds hits and what you worry about it then feeling would be important you would either need to have something before the session or consume it during the session so one of the other things we'd like to say here is recovery starts during the previous workout right so if you're working out right now and you optimize nutrition right now even if you don't necessarily need it for the current workout if you can get ahead on recovery then you're going to be fine

01:22:37 the next day and the differentiation here between carbohydrate and protein is important so the total amount of protein you ingest throughout the day is probably a bigger determinant for things like muscle growth than the timing so the post exercise anabolic window it doesn't necessarily matter carbohydrate is different the timing of that does matter it needs to be around and available so you can maximize both hydration and muscle glycogen resynthesis which is restoring the muscle glycogen you burn during exercise

01:23:07 um I also work with athletes that train multiple times a day so in those particular cases recovery window is half what you normally have so if you're in a situation where you have two or three days before you work out again you don't need to worry about getting carbohydrate in before during or after Because by the time you go to train again you will have restored your muscle glycogen levels easily however if you're training every day or twice in a day then the timing of carbohydrate really starts to matter and

01:23:33 in that case I see no reason to not ingest those nutrients either before during or after you don't need to necessarily do it but you can the general rule of thumb I give is something

like this um if you're doing something where you're trying to really work hard whether this is hypertrophy training or a lot of endurance energy expenditure is going to be high potential muscle damage is high and or energy utilization is high what you want to look for is a number something in the area of like half a gram of

01:24:05 carbohydrate per pound of body weight so you weigh 200 pound you want to make sure that either premid or post or total you bring in 100 grams of carbohydrate it's just a very rough number to start protein is about half of that so it's about a quarter of your body weight right so those numbers would be if you're 200 pounds make sure you have 100 grams of carbs and 50 grams of protein and again it doesn't necessarily have to be before or during or after and you'll be in a good spot all you need to do

01:24:37 then is Alter well what I do I should say is Alter the amount of carbohydrate based on energy expenditure so a lower energy an easier workout instead of having 100 grams of carbs I might tack that down to 75 or even 50 and be one to one carb protein ratio if it was even harder more sun hotter outside more fluid loss I might go from 100 grams of carbs up to 150 or 200 and get closer to like a 3 to1 or 4 to1 carbohydrate to protein ratio so those are the numbers that I generally go by well as I take a sip of My Double

01:25:16 Espresso Americano here I'd love for you to tell us about stimulants sure there's no shortage of these in most of our lives and of course you can cover the health benefits of it later you maybe you have an episode yes we have an episode on caffeine and it does have certain health benefits although one has to use caffeine correctly in order to drive those yeah so there's caffeine is the easy one to start with and we won't blur the point here uh the evidence is strong it has an ergogenic effect uh you can

01:25:46 take it at whatever dosage is reasonable for you and of course there is uh a bit of a learning curve there such that obviously the more you take it the more you need to take even though there's actually some recent evidence showing even folks who are uh acclimated to it will still see an ergogenic benefit even though if they don't feel a big boost of it so typically that takes 30 to 45 minutes or so but it's highly dependent upon the person so some people can smell coffee and immediately feel better and

01:26:13 that's probably working actually through a different mechanism um of anticipation but you can take it there the half life of it is you know 4 to 6 hours or something like that it can totally depends on the person so don't let ruin your sleep but if you take it prior to Performance it has a a noticeable effect on particularly endurance maximum strength maybe less well quite less so um in fact the data are mixed there on whether it actually does anything for Peak strength although I think most people would uh re would

01:26:43 suggest that you know you're going to take it prior to trying to truly lift as as high as trying to you know lift a one repetition Max or similar but most of the the documented effects are on the the endurance-based SE activities yes so my read of the literature uh in terms of performance-enhancing effects of caffeine are that one to three milligrams I want to make sure that people hear the units correctly before people Blitz themselves out with that caffeine one to three milligrams per kilogram of body weight

01:27:13 about 30 minutes prior to exercise has a definite performance- enhancing effect it also has a definite mental performance-enhancing effect especially when people who are regular caffeine users have abstained from caffeine for anywhere from 2 to 15 days and and that's an extremely rare circumstance but even if they have not it appears that 1 to 3 milligrams per kilogram of body weight of caffeine taken about again it's not super precise as far as I uh can see uh about 30 minutes before the event starts um can really enhance

01:27:50 reaction time and power output and uh as well as as you mentioned endurance when I was researching the caffeine episode one interesting caveat that um I discovered was that if people are not caffeine adapted they are not regular users of caffeine the sudden introduction of caffeine can really degrade performance mostly because people don't know how to operate at that high level of autonomic arousal have you ever observed that yeah 100% in fact there's actually data going up as high as 10 milligrams per kilogram

01:28:19 of body weight wow which is in fact once you cross the five m milligram per kilogram threshold you will start seeing performance decrements so there's absolutely such a thing of ruining your performance with too much caffeine so most people listening to this if you're thinking wow they said caffeine I'm all in and then you just stopped listening and now you you know go for your quad espresso shot before every time you go to workout you probably passing that threshold if you think about those numbers 1 to 3 milligram per kilogram

01:28:51 body weight if you weigh 100 kilog that's 220 lb that'd be something like 2 to 500 milligrams of caffeine which is like a pretty high amount um but you know a coffee is going to get you close and espresso is going to get you somewhat in that ballpark depending on source and stuff um so you don't really need to go and blister your brain with caffeine in fact if you do it's quite common and in fact likely that you'll actually make performance worse right yeah the amount of caffeine in different coffees and

01:29:21 sodas Etc of course varies one thing that ought to know is that the smallest of commercially available um coffees at the most popular commercial vendors um generally contain

anywhere from 250 to 350 milligrams of caffeine what that means is that the so-called medium and the large contain as much as 500 milligrams or one gram of caffeine so for you morning um large coffee at a commercial vendor um uh drinkers if you're wondering why you get an A headache if you're 30 minutes late on that caffeine or um if you can't access

01:30:02 that caffeine at all or even if you're drinking C coffee excuse me from another source you're finding like oh it's really not doing it for me it's because the amount of caffeine in the now commercially sold uh coffees is exceedingly high it's about two or three times higher than the standard lookup tables that you'll see on the internet so I'm not saying that to demonize caffeine we can pretty quickly adapt to form of tolerance to caffeine um some people never really can get over the Jitters other people um are just fine

01:30:31 with even a th000 milligrams of caffeine but only because they've been drinking a lot of caffeine consistently anyway it's also wildly inconsistent from location to location uh The Brew type the functionality so yeah that that stuff can be very hard to figure out what what's happening there's only one way really to uh objectively measure caffeine and that's use caffeine tablets and they work pretty well actually uh someone I know um who's prominent in the podcast space uses 100 to 200 milligrams

01:30:59 of caffeine in tablet form combined with tea so they've now conditioned themselves to think that herbal tea actually has this caffinating effect but um tablet form caffeine while I'm not recommending it to to uh outright it is going to give you the best sense of how much caffeine you can tolerate and how much is performance enhancing or is performance degrading there's actually another line of supplementation we can go down here which is not technically a stimulant but it's something I use to help performance when you don't want

01:31:31 caffeine and so this think specifically if you're one of those folks who have to exercise at night and you want a little bit of boost for your training but you don't want to have caffeine because it messes up your sleep and this is when you can turn to the whole like citrine Arginine nitric oxide sort of route and uh we'll skip the explanation there but effectively what happens is nitric oxide is this wonderful compound that causes vasodilation and of course that's going to aid then in transporting

01:31:59 nutrients in and out of the cell um so it has an ergogenic effect the you have a number of ways you can go about this um some of them have more pros and cons than others and and there are more and more data coming out specifically on citrine more recently if you look though in my opinion the most consistent evidence for the most consistent effect is in the supplement of beetroot or beetroot juice or extract or something like that so you can find those supplements and they tend to uh again they're pretty effective at enhancing

01:32:30 performance specifically anything moderate to longer duration endurance performance and they are not a stimulant so they won't ruin your sleep that much now one um note of caution uh for those of you that are interested in citrine or or beetroot because they are in the Arginine pathway if you're somebody who has um a predisposition to cold sorce um oral cold sorce that is or other forms of cold sores that um because activation of the Arginine pathway can exacerbate some of the neural related aspects of of

01:33:01 cold sores and that's because the viruses that cause those cold sores actually live on neurons then you want to be very cautious with citrine especially high dose citrine I can really amplify that the cold sore response what about non-stimulant yet um focus enhancing supplements things like Alpha GPC um for example I routinely use 300 to 600 milligrams of alpha GPC prior to hard physical training typically weight training but occasionally I'll take 300 milligrams of alpha GPC prior to a mental work bout um less often

01:33:39 these days because I kind of reserve it for physical training uh and I don't tend to use it every day maybe once every you know third or fourth workout combined with caffeine so that combination is pretty uh pretty potent I find and so technically because it's a coleric Agonist it's not a stimulant in the traditional sense but it has a um focusing and an alertness promoting aspect to it what are your thoughts on those sorts of compounds there's not much human perform exercise performance data on those there are certainly

01:34:13 cognitive functioning tests on those so you're not going to find a lot of information no though there isn't none we actually will use many of these substances you could globally call them neutropic which is you know any substance that specifically will enhance brain function is a rough way to think about it will use them prior to more challenging bouts of training um this is something that we'll pull out say on sparring day only um or the most important training session or a session when you're trying

01:34:41 to work on Pitch command or when you're trying to enhance uh work on your shot and as a basketball player or you're really trying to improve a certain swing as a golfer or something like that but we do not use them every day we do not use them with every person so yeah we will use those um they are not stimulants but they can be performance enhancing and another kind of way to think about this is if you're in the case of caloric restriction so whether you're trying to lose weight or we're actually trying to control weight for

01:35:08 you know weight purposes in terms of a sports where you have to be in a certain weight class or something like that what we may not be able to give you food in fact we may not be

able to give you stimulants because of the sleep thing or because we're already like maxed on on stimulant um now we can go this route and so at least like mentally you're a little bit there and you're more likely to be alert and focused and you can train harder despite the fact we didn't actually change fuel now that's a little

01:35:31 bit of a short game in terms of that's not your permanent solution you eventually need to bring calories up or you know whatever other train you're training or whatever you're going to do but it can work in a nice short pinch I'm very interested to learn from you about fatigue reducers and I'm hoping that Roda Rosa will come up in the conversation yeah great let's just start right there then there's actually a lot of research on this despite most people not having heard of it uh I think I mentioned in a previous episode I've

01:36:02 used it a lot over many many years um you have to be a little bit careful of it there's well first of all no we we should have said this at the onset there no supplement is a Panacea right nothing's going to work for everything in rodea is no no different it can have a number of effects if you look across the literature you're going to find generally somewhere between a small benefit to little benefit um but not often is it detrimental with a few exceptions I know of a handful of papers that would be two specifically where it

01:36:31 may actually reduce muscular endurance okay fine if you think about what's happening is one of the benefits that has been seen so far with riola is it is helpful at managing cortisol but cortisol suppression is not a necessarily a good thing we talked about how if you do an acute B of stress cortisol will go way up and that is a sign of of acute stress however a sign of longterm excessive stress is cortisol suppression and so this is a thing to be really careful of is if you're feeling down or lethargic or tired and you think

01:37:06 your adrenals are messed up and then you start taking cortisol modulators you could be making the problem worse because now your cortisol is actually suppressed and now you're taking these things to blunt it or keep it low and and you're you continue to feel lethargic and and lack of desire and libido and focus and and sort of all these things so cortisol is not a bad thing um we want this to be going up and down uh in the amounts that we want so if we're we're thinking about like for example waking up um you would want

01:37:33 generally something like a 50% reduction in the first hour in terms of cortisol concentrations however if you're extremely suppressed already um going down is is only going to be a problem so riola is is has a a good evidence-base to support it for that um you'll see actually a number of studies that have looked at it in a whole host of areas um for benefits so something good to do um the difficult part with riola to be quite honest is getting it from a high quality brand and Source it's difficult to get as a single source

01:38:03 which is a very very important thing to do with supplements is try to get them sourced alone riola typically comes in combination with any other herbals or other stuff you adrenal support and etc etc um also then getting them then third party certified which for most folks is not necessary but for any athletes that need to go through drug testing systems you should not take any supplement at all that does not have some sort of third party certification so those are the challenges that being said if you've

01:38:31 ever ran into into somebody who's taken riola and they're like it didn't do anything for me it that's possible that's you know nothing works for everyone it also could be just very poor quality sourcing um so if you look at uh the there have been a number of papers on um its perception of fatigue and You' sort of mentioned that you felt pretty immediate effects I've taken it a few times yeah I'm fairly sensitive to supplements but I've started taking uh Rola before workouts and found that I could push much harder much longer

01:39:06 through the workout normally I would or typically before taking it um that is in sessions where I did not take it I would be able to work out very hard for 20 minutes or so the next 10 minutes I could get some work output and then the remaining uh period of time it was kind of a tapering off now granted these are very intense training sessions these are not the endurance training sessions these are the weight training sessions that one one time per week per body part type sessions uh what I've noticed is I

01:39:35 can complete the entire 60 minutes with with minimal fatigue now I mean obviously I hit fatigues within sets and of course you know I you remain human despite taking it but um I found to be very useful and I've been using it whenever I use Alpha GPC prior prior to workouts yeah and I've been impressed by by it overall I do want to highlight something that you said because I think it's so so vitally important which is that using single ingredient formulations for most things is critical to figuring out what works for you what

01:40:05 doesn't what dosages you need being able to take things uh two on one off um two days on one day off for instance being able to um increase dosage in the morning and then com maybe reduce the dosage and combin with something else in the afternoon single ingredient formulations are pretty much the only way to do that there's perhaps only one supplement that I take at all and that's athletic greens as they've been a regular podcast sponsor for a long time that is a cocktail of many many things and those are all adaptogens as well as

01:40:34 some probiotics and vitamins and things like that so I'm not opposed to Blends where the Blends include a lot of nutrients that are synergistic but for all pill capsule uh based

supplements where I'm looking for a very targeted effect and it's not just about sub uh foundational nutrition I really believe strongly that single ingredient formulations are the way that you can build a rational approach to supplementation and also make adjustments if something isn't making you feel better and also make

01:41:02 adjustments if something's really working for you so for instance some people might take Alpha GPC 300 milligrams and not feel anything go up to 600 milligrams not feel anything maybe just feel kind of eh they don't like it other people like myself took 300 milligrams of alpha GPC the first time I was like wow this really puts me in the zone but I want to be really careful how often I use it I did mention I go to 600 milligram occasionally but that really puts me on the outer threshold of kind of overall levels of

01:41:29 focus and amped up such that if I drink too much caffeine it can tilt me over the edge so I encourage people to become scientists of themselves and the only way to do that is to try and limit the number of variables and the final point is that I think that single ingredient formulations are by far the best in terms of changing things over time you know this could be um uh women during their menstrual cycle might find that during certain phases of the cycle they're more sensitive to certain things

01:41:56 than not others um and for men and women it may be that you know certain times of year even and uh certain supplements might go better closer to sleep some earlier in the day and on and on and on there's just no real way in my opinion to have a supplementation protocol that involves lots and lots of Blends one or two Blends okay but lots of Blends I think that's um I actually think that's potentially dangerous territory yeah I mean just take Roda as good example I know a new meta analyses came out just

01:42:26 in the last few months looking at it and they found in general you see again a slight to moderate Improvement in everything from uh Power output to fatigue resistant antioxidant effects um to endurance performance so it's like okay great maybe there's a little bit here now let's say you went to do it and the only way you could access riola is in combination with that and um some Lion's man and you know some other of these adapted dens and was like well wait a minute I just wanted to take this to get a

01:42:55 better workout but now it also came with this stimulant or this cortisol suppressor or cortisol activator well now all of a sudden you can't take it at night or you can't take it in the morning because you're already you already had coffee your your options are just way limited so I think the biggest part of all that is you if something doesn't feel good you have absolutely no idea you don't know if it was Rola you don't know if it was the BSW that's in there you don't know if it was any of the other things that were smashed in

01:43:20 there or it could be something as simple as the um the citric acid they use like some other combination of thing and now here you are thinking that some supplement that actually works for you doesn't and you throw that out of your repertoire uh for the rest of your life which is you know not the biggest crime but it's not needed and you're not really going to know so yeah I fully stamped you can look back at my course lectures for the last decade and you will see like stamped number one on the

01:43:46 supplement sections is make sure you're taking single ingredient supplements at all costs the last part about that too is you're more likely to ensure the amount that is on the label is correct so if you're taking riola and it says you know it's 100 milligrams in there and if that's the only thing that's in there you're more likely than not to actually get something close now they're never perfect but it will be close if it's in a combination of 20 other things you actually don't have any idea if

01:44:17 that's in there um in fact there have been many papers on um melatonin and vitamin d and a number of other supplements in which when you actually just pull them off the shelf these are standard studies where they will go on buy say like 20 to 25 different supplements in the case of melatonin and we'll actually measure the amount of melatonin actually in them and despite the fact that the label says 5 milligrams they can be up to a 500 to a thousandfold actual concentration in that supplement and then you wonder why

01:44:45 some people react great to melatonin some people that absolutely destroys you and this is also why like we'll see this constantly well people will have like 5 100 times the upper limit of melatonin the morning after when the halflife is supposed to be more like 90 minutes it should be totally gone but we're seeing extremely high I'm not even talking like double I'm talking 10 20 30X the upper limit range for melatonin the next morning and then it's like well what are you taking

01:45:11 he's like I got this melatonin at X store or X website and you're like holy cow um so I'm not opposed to melatonin theoretically um but you have to be careful with that one in particular so any supplement has that to be true so you want to buy them from as many places as you can that are high quality and if they are third party tested even if you're not a performance athlete I want to stress this even if you're not a performance athlete third-party certified and test of supplements are you're less likely to

01:45:42 just just get wildly high concentrations or low concentrations of active ingredients and so relative to other ones who you might get for cheaper but you could be totally wrecking

Yourself by getting you know 50 Mill grams of melatonin every night and not realizing it so then of course the next morning you drown yourself in caffeine and then you can see what death cycle you're in now yeah um people can look for third party certification on the packaging and um some websites will allow you to zoom

01:46:07 in on the bottle beforehand it's largely listed on on certain um vendor websites a brief point about supplement cost and blends and I promise this will be a brief Point different ingredients meaning different types of supplements have widely varying costs in order to you know create to to get them to manufacture them so often times what you'll find is that blends will um include the least amount of the most expensive uh ingredient right um not always the case there are some there certain exceptions to this and I

01:46:42 mentioned some Blends that I like a few minutes ago that are for foundational nutrition adaptogens and probiotics athletic greens of course just being one of several examples out there but when it comes to say a sleep Blend or a pre-workout blend there are some decent products out there but a lot of them tend to put in more of the least expensive ingredients and less of the ones that you're actively seeking and so those tend to be uh caffeine tends to be kind of a buffer against the other things meaning if you pre-workout

01:47:13 putting caffeine in there isn't necessarily a bad thing but if it has five other things in there often times what manufacturers will cheat on is the actual amount of the things that are costing um so again single ingredient formulations for 80% of your supplements I think is really um the way to go and the other thing I know is going to come up as we're talking about all these supplements is this issue of dependency I often get this question and when I solicit for questions uh on social media in anticipation of this episode number

01:47:43 of people said okay so if you take a sleep formulation do I need to take it every night if I don't take it will I have an incredibly hard time sleeping if I take a pre-workout every time I train will uh will I need it um it's a great question um some people will take supplement holidays as they may be called um for a couple of days each week back to back some people take them straight through I myself take a a sleep cocktail we've described this it's magnesium theanine and things this is not one ingredient these are multiple

01:48:11 ingredients in fact precisely because some people who have sleep walking and Vivid dream issues can't take theine before bed in any case I've had times when I either forgot my supplements that's rare or I just didn't have what I needed or just simply took a break for a night and it was not a problem um but in terms of pre-workout I do think that people become dependent on being in that really ramped up state but I don't think we view all this as like true dependency kind of like addiction totally right I

01:48:40 mean I Define addiction as a progressive narrowing of the things that bring you pleasure so you know I I suppose people could get addicted to pre-workout but it seems a little unlikely more likely there would be a dependency such that if you didn't have your pre-work out you might feel like oh you're not motivated to train so what are your thoughts on um taking little holidays from supplements and varying the frequency of supplement intake in particular as it relates to stimulants and fatigue reducers the end

01:49:07 goal anytime I coach somebody is to get them into a physiological state in which they require no or close to no supplementation that's the target we should really be in a position to where our lifestyle our sunlight exposure exposure our Stress Management our physical activity our sleep and our hydration and our whole food nutrition provide us almost everything we need now look again there are some foundational items that we can give people um we put together a little bundle actually for this that of basic things that you can

01:49:39 go look at but that's the goal right so the target is to be let your physiology run the guy your physiology is way smarter than we are even if I take a bunch of biomarkers from you your physiology still knows better than those few markers can tell me so that's always where we're ending up I actually personally don't like people being in a position that they have to take a supplement for anything so I don't like it if you have to take a supplement to have a good night of sleep I don't like it if you have to have a supplement to

01:50:07 train we will use any of these stimulants very very carefully uh with any of the athletes we work with and certainly for the non-athletes because at least the athletes we have an end date we have a fight scheduled we have a season we have a game you're going to pitch whatever when you don't have that it's sort of like you're in this endless cycle of oh you're just going to do that all day every day we don't really need to be in that spot so what I the way that I describe My Philosophy is I will

01:50:34 use those short-term tactics to symptom manage if I have to so if somebody comes to me and they're like you're feeling awful and we've got to get through the hump okay great maybe we'll give you something for Sleep immediately to get you sleeping that allows us to then come back and work on the causal problem right so this is what is why are you having a hard time sleeping anyways if you have to take a a nine cocktail supplement to sleep then all we're doing is is blinding the reason why are you in

01:51:02 that position to begin with right so we see this all the time whether it is sleep problems whether it is cortisol or testosterone the question is why is that low now we may give you

something again to manage it immediately but the task uh the mystery I'm going to try to unveil is why why is it there to begin with this could be something like this is natural for you and your lack of energy is something else or could be actually it is not a natural level for you but something is suppressing it any number of uh you've

01:51:29 got some infection going on there's some allergic reaction to something in your environment there's a you know mold um Mercury like that one comes up a lot you'll see Mercury and folks and that's causing a lot of problems um or any number of heavy metals or toxins any host of thing psychological distress bad daily habit you don't ever see the sun like you don't ever sweat you don't ever drink we've talked about so many things so I'm always is going to hunt for that and I hate using this phrase it's highly

01:51:56 maligned for a good reason but root cause all right so we're trying to find that is like are we making sure that we're not causing this problem and I'm not going to want to give you a supplement to cover up something if we're not even trying to solve the problem of what's being there that being said am I that concerned about people taking a multivitamin just all throughout no not really am I concerned about people taking creatine no like go ahead um those ones are generally pretty fine to to just take but anything else I

01:52:27 want a reason I really don't like giving people anything in a super physiological concentration or a superfood concentration right so again an amount you wouldn't find in a normal food dosage unless we have really a specific reason some of these things are more problematic others are less problematic so when I to answer the question of dependency you have a combination of actual physiological dependency caffeine like that actually creates a physi iCal dependency versus a uh emotional or psychological dependency or just a l

01:52:59 like drinking this like that's my habit that's my routine there's a fancy scientific phrase for that but it doesn't matter so yeah we want to get off that and like again my personal philosophy is I don't want you dependent upon anything I want to create extremely resilient people and I want to create physiological resilience we actually have a fancy little algorithm we use to to measure that in people and so we can actually calculate that number and the goal of us is to push that number higher so that we don't have to have anything

01:53:24 um so many situations pop up in your real life that you're not going to have your supplement or you're not going to have your routine or you're not going to have your journal or whatever but also for the long term I don't want to create a situation in which this is a short-term success that you have to now do that the rest of your life no let's just get out of the way let's fix the problem if if there is something symptom management that's real while we're actually searching for better foundational habits um the last thing I

01:53:50 want to say about this is if you're only covering symptom you're really missing signal right which is if you're constantly tired throughout the day and all you're doing is giving yourself a number of Alpha gpc's and caffeine Etc even though there's good literature are you really just using that to allow your poor sleep hygiene to happen if you took those away I bet you you would actually start addressing your sleep if that's the Cause right or I your your stress or your poor hydration like you would go

01:54:19 hunting for the problem and so like you want to walk a fine here of going like hey look is an athletic greens supplement that big a deal no probably not but wait a minute am I actually now covering up the pain point that is maybe needed it's a signal to actually get my ass in gear to go make one of these changes um whatever it needs to be so I know I got like a little bit meta on you and a little bit philosophical but that's honestly how I approach it yeah I think it's really important a friend of

01:54:48 mine who's a physician has a great saying um which is better living Through Chemistry still requires Better Living um boy that's that's golden that's so good you know and it pertains also to things like anti-depressants and ADHD drugs and things of that sort most all of those things were developed as tools to allow people to move from a maladaptive State maladaptive is hard to Define but think about in any domain of life you can either be back on your heels flat footed or forward Center of mass um and there are times when people

01:55:19 are so compromised neurochemically that they need to use pharmacology in order to get into a flat-footed position yeah you know they're really back on their heels flat footed or forward Center Mass but the idea was always that those things were developed as things to allow people to engage in the sorts of behaviors that can produce the same sorts of neurochemical shifts and if people are thinking well what sorts of behaviors can induce these neurochemical shifts I'll just zoom out myself for a moment here and say I am a big proponent

01:55:46 I believe you are as well F May in doing behavioral tools first when possible really establishing good habits the dos and don'ts which we've talked a lot about in this series and in this episode then excellent nutrition which involves dos and don'ts volume food Choice timing all the factors and then also supplementation and also there sometimes a case for prescription drugs certainly and often brain machine interface or body machine interface measuring stuff using devices but the the foundation of

01:56:22 behavior and good nutrition are really truly foundational and it's hard in anything to skip steps but supplements and prescription drugs are one place where people often skip steps

and then they they don't actually learn how to cultivate the best uh behavioral practices including the don'ts as you mentioned and then just one more point along these lines you know you talked about taking anything for energy is really uh disruptive to the system and it is because especially caffeine while it has its uses and even health benefits

01:56:54 it's really borrowing it it's against the adenosine system with interest and so because caffeine acts as an adenosine antagonist effectively while caffeine is present in those receptors you don't feel as sleepy you have more energy you're reaction time goes down memories enhance Focus performance of all kinds yes but then when that caffeine is dislodged from the receptor then the adenosine can act even more potently at those receptors so it's sort of like being able to borrow against the normal

01:57:24 variations in wakefulness and sleep and this is why we encourage people if they're not training first thing in the morning to push their caffeine and take out about 90 to 120 minutes after waking so they can clear some of that adenosine in the morning which tends to happen even uh uh after we wake up um people can listen to episodes on Master your sleep or perfect sleep or the caffeine episode to understand more about that but the the final thing I just want to say here and then it it um prompts a

01:57:48 question is you know in thinking about supplement protocols um I think a lot of people assume that once they start taking something they're going to have to take it all the time and one idea perhaps is that people have some uh Alpha GPC around that they could take and granted it'd be great if people could try things without having to buy a whole product I think companies hopefully are listening to this and we um give people a sample to see if something works for them and then give them an opportunity to try it to have

01:58:18 things around but not necessarily assume you're going to take it every time right some things you take every day foundational nutrition um uh supplements for instance but then also to take a look at how well you're eating or not eating right at times when I'm eating much better I consuming you know low sugar fermented foods which are great for the gut microbiome I consume less probiotics if ever I've been really compromised for whatever reason then I will take pill form probiotics but I don't take those all the time um because

01:58:45 I get them from food and from certain G you know greens drinks like athletic greens and so forth so I think that nutrition and supplementation are are tethered in this way in my mind and I don't think that um most people think of supplementation as something that where you can induce a lot of variability in when and how you take them but as far as I'm concerned as long as there single ingredient formulations you can be um you can use supplements once a week if you want you could use them seven days a

01:59:10 week you could use them um twice a day four times a day every day or you could use them not at all agreed yeah some of them uh will have an effect randomly like that others will not and we talked about creatin being one of them it's if you're going to take it once or so a week then there's I mean basically no benefit that's a very good point creatine um beta alanine is another fantastic example of something you need to take consistently if you want some sort of benefit um it needs to be built up in muscle we need to use that to

01:59:43 create uh carnosine which is what's actually going to help us with our fatigue management that's why we call it like an acid buffer um so in our previous metabolism episode we talked about that being a major cause of fatigue um the wonderful part the one of the reasons why beta alanine works so effectively is it blocks that buildup so that is an example of another one that you would want to take uh other things like fish oil you could certainly skip a day here and there it wouldn't be that big a deal I also do support your

02:00:08 comment of you can take absolutely none of these things and and be just fine um in terms of and we'll come back maybe to bet Allan in a second in terms of some other fun stuff my colleague Greg giki ran a really cool number of studies looking at how exercise actually alteras that got microbiome this is actually an area that we I probably have 300 stool samples sitting in my freezer in my lab oh goodness another reason to pause before entering your lab yeah another reason to not apply to come be one of my

02:00:37 graduate students unless you want to deal with that um we actually have a number we've applied for a couple of Grants to look more into this um specifically with females uh so hopefully we can get that funded but nonetheless um you can actually see some like pretty traumatic and I say that word on purpose changes in the gut microbiome this one in particular study I was thinking of that Greg did is he looked at the the changes pre-post and ultramarathon and even within a single bot of exercise um I can't remember some

02:01:04 of the markers but I know one of the markers uh was specifically increased by like 14,000 per. uh after a single bot of exercise now this is an ultramarathon this is like like totally absurd amount of exercise relative to what normal people would do would be but that number I remember like it was like 14,2 29% or like something some random number like that of something meaningful yeah something meaningful I can't remember which marker uh that was that had changed um I know strepto caucus was in there strepto caucus went up like

02:01:37 maybe something more like 30 or 40 or 50% so the point is we haven't even had the proper time and we don't to even launch into the gut microbiome um supplementation there needs

to be ultra specific um you wouldn't be best served to just jump in and take random things there um that's it's a whole area of emerging science we know very very very little about it but there is a number of actionable things one could do um there so probably something to not mess with uh would certainly work with a qualified

02:02:07 physician if you think you have something going on clinical or you know some actual problem there don't work with someone who's not a specialist a medical doctor there but um just randomly assigning a bunch of probiotics or prebiotics without intention is is maybe um the next Forefront of human performance research but we'll have to maybe come back in a few years and dive into that in detail or perhaps you can bring somebody on as an expert in that to discuss that yeah gut microbiome is fascinating I think of sleep as the most

02:02:37 powerful performance enhancing activity uh of course you still have to do the activity yeah I consider it foundational like it basically raises the tide on mental health physical health performance of all kinds um it there's recent data that during sleep your body goes through all its various forms of metabolism possible Y which is amazing so it's measured from breath in human subjects breath metabolites in human subjects so obviously uh if one is thinking about supplementation and wondering okay

02:03:09 what's what's the best supplement to enhance performance you gave some um great rationale for why creatine would be an excellent choice provided you're eating well and um hydrating well uh and then to my mind the next thing on the list would be anything that allows you to improve the quality and maybe even the duration of your sleep although if you wake up and you feel rested throughout the day and only need a short nap in the afternoon not everyone needs one but then generally that means you're feeling okay people

02:03:38 sometimes get flipped onto this idea that they have insomnia insomnia is excessive daytime sleepiness where you're falling asleep during the day that's insomnia could also be narcolepsy but that's insomnia but supplementation to improve the quality or duration of sleep or both seems to me like the most direct route even though actually technically it's an indirect route to to uh performance enhancement and then thinking about things that increase alertness and stimulant and F and fatigue reducers do

02:04:08 you think that's a good logic yeah we go to absurd lengths to dial sleep in as much as we can I mean the honest answer is like truly absurd this is a conflict of interest my my company I'm a part of this absolute rest is the name of that company we actually go out to your house and run a full clinical grade sleep study in you your bedroom on you and run that over multiple nights so instead of having to go to a Sleep Clinic and have it done in this weird hospital room or sort of setting with these people

02:04:36 looking at you through a mirror it's like totally creepy um that is important because that's the only way to truly determine how you are sleeping now that said the technology of wearable trackers is getting better in fact I would actually predict those things will reach a level of accuracy equivalent to the PSG in the next couple of years and probably we'll get FDA approval to be able to diagnose officially Sleep Disorders that's my total my prediction from some inside information I don't know that to be true but it is getting a lot

02:05:04 better right now those wearables are not accurate enough to meet that threshold so that we do is we bring up basically all the equipment um to do that so we'll come in and do that now once we understand exactly how you're sleeping the next question is to answer why are you sleeping that way and so this is a full four-fold system um number one is we're going to look at biology which means you're going to take saliva and blood and we're looking at everything from uh neurotransmitters concentrations

02:05:30 to um vitamins B6 B12 Etc that are important for Sleep performance so we're going to see is that is it a physiological problem is there something happen there is cortisol DHEA ratio that we've previously talked about or uh is something like that off if it's not physiology then we're going on the next one which is environmental we run a full environmental scan of your bedroom during those nights of sleep that we're there and that's really important because we can look at everything from dander and pollen and allergens that are

02:05:57 in the air um a quick tip here is wash your sheets at least once a week one of the common most common places that people um get allergens in the air is actually from accumulation on your sheets so if you clean those more often uh you'll be in a better spot and next one the next one there also is like keep your I'm sorry this hurts my heart I don't even VI I in in truthfulness I violate this but keep your pets out of your bedroom and certainly keep them off your bed our our Ghost Face Killer is my

02:06:28 dog and no is my other one they don't go on my bed but they're right next to my bed so we violate that one but full environmental scan uh includes all those things of course there's uh we measure light and temperature and humidity and everything else that's going on in the room um volatile Organics that are coming out of the mattress from Mal theide lead out of out of the wall like all these things that could potentially disrupt your sleep and we want to make sure that none of those things are kicking on uh we see this constantly

02:06:55 people will have things like trying to be cool and they want to be cold at night because that's important and so they'll turn an air conditioner on or a fan but the air conditioner

kicking on and off and night actually can shoot you out of various sleep stages so you want to be really careful how this going the last metric on that is actually CO2 and so what you remember from our metabolism discussion is when you exhale you're breathing out CO2 well if your room is closed and the ventilation isn't great

02:07:21 the amount of CO2 in your room starts to build up and we actually very specifically know the threshold uh based on information collected from the International Space Station actually we know the Threshold at which CO2 crosses and starts disrupting sleep so we want to make sure that you're not sitting in this CO2 bath in front of your face and then breathing it back in and disrupting your sleep so environment is the second one the third one is actually now psychology so um one of the members on our team is a Harvard MD and Psychiatry

02:07:48 and put together an entire sleep scan survey so we run through all that to see if there's anxiety depression anything like that psychologically going on and then the F fourth one there is if you have some sort of actual sleep pathology and so this again will include some eye tracking stuff that we can use so we take all those data they go back to our team uh we work in combination with with Steve locky uh from Harvard who's done a ton of stuff he actually set up a lot of the Circadian rhythm stuff in the

02:08:13 National Space Station as well uh himself Jeffrey Drummer and mdphd Etc and all these folks in a room go over your data identify what's going on in build action plans off of that occasionally those action plans will include supplementation but only if necessary we're really going to try to come back and work through a system um to improve the Sleep however is needed so I realize that is not U totally accessible for a lot of people but like if you really need to go to the end of the Earth to figure out sleep um that

02:08:43 service is available absolute rest sounds like an amazing tool given that most people won't be able to use it um or access it although we will provide a link in case people are interested in it and do want to try it you mentioned a few things that I think everyone should uh assay their sleeping environment for and um determine whether or not they are hindering their sleep uh without realizing it for instance the uh air conditioning going on and off or this could be heater going on and off or um

02:09:13 central heat heating or cooling unit um this could be uh keeping the room dark uh this could be uh cleaning your sheets certainly that doesn't require um uh that one sign up for absolute rest so cleaning one sheets routinely keeping pets out of the bedroom as you admitted you don't entirely um different opinions about that but if you're having sleep issues the dander from animals may may be part of those issues and then one that I'll just add which I think is pretty interesting is there's some beautiful data out of Michael turman's

02:09:43 Lab at Columbia Medical School in New York um on negative ionization and this sounds pretty uh wacky new AG I'm sure some you are like negative ionization but listen the termin lab is a serious laboratory focus on circadian biology for many decades now negative ion concentrations are higher near Coastal locations so if you've ever gone to the sea or gone on vacation and you sleep better near a body of water that's actually a real thing and there are negative ionization machines but there are also some things that one can do in

02:10:14 order to increase the negative ion concentration in their sleeping environment that are nearly zero cost if not zero cost you can look those up online and we probably will do an entire episode about this in the future but I think what you describe for absolute rest really highlights a more General set of themes that I think are really important which is your sleep environment is an environment it's got a lot going on in it and it's worth running through the checklist uh that you described and asking you know where

02:10:41 where things you know maybe not optimized but where am I really getting in my own way in terms of sleep all of this again being related to the fact that getting excellent sleep consistently is a will completely transform everything that you do and not getting excellent sleep consistently which is a challenge for so so many people uh will also transform everything that you do and think and feel but in the negative Direction yeah I can also offer a few tips uh on sleep based on things we find most consistently for those that can't

02:11:09 go through uh the whole protocol um one quick little actually app called time shifter is really cool for anyone that's dealing with consistent travel and jet lag so you can go and enter your location your time where you're going the location and then it'll actually back calculate and it'll give you full light uh stimulant food hydration and stuff protocol and you just follow along with that and we've used that for many years actually especially when traveling to like Abu Dhabi for vice and Mongolia

02:11:38 and and Brazil for the Olympics and sort of all over the place so um that's I think that app is still available I hope so um it's it's great um a nice tool um a couple of things we found major if you're dealing with acid reflex so if you're someone who who has problems like that you can just Elevate the head of your bed by like 6 in so if you you know put a little piece of wood or something underneath it um you can also buy very inexpensive pillows um that can Elevate that now that's not solving the problem

02:12:06 but at least can help you sleep whether it's just that night or if it's a consistent problem you can do there um if you're snoring like I said that's not really benign you should probably

take a look at that your first step there is mouth tape um if that doesn't work you can go through what's called myofunctional therapy um which I don't know if you've covered that before but it's basically tongue exercises uh and that can be quite effective specifically for people who have problems with REM sleep so

02:12:31 malfunctional therapy um it's just a it's kind of like you do like depending on the protocol uh some tongue exercises kind of in the morning afternoon or night and that takes a while to be honest uh you're probably going to need at least six weeks before you start seeing anything but that actually is is pretty well demonstrated to help with sleep so you can probably Google you could find a link for for exact protocols I don't want to describe all them but yeah you're going to strengthen your tongue so that it stops falling in

02:12:56 the back of your neck and waking you up at night so that's a really free easyfree protocol to use um if you're struggling with it could be insomnia but it could be just things like when you get into bed you're super tired you can't fall asleep or things like that kind of a basic rule of thumb we use is only two things happen in your bed and if you can make sure those are the only two things you do in your bed the problems of falling sleeper insomnia tend to go down those two things are you have sex and

02:13:24 you sleep and nothing else goes down in your bed and so you can make that environment very special and that can help uh quite effectively improve your ability to fall asleep and then not wake up early so keeping that environment specific to what it's for uh can be effective the only other thing I would think of is and I I hate to say this because it's not super practical but it's just quite clear at this point sleeping with a partner in your bed it's just not very good for sleep so good luck with that one I know um you can do

02:13:55 a couple of things if it helps uh you can get two smaller beds and put them right next to each other um if you can actually have separate sheets that alone can be helpful um so if you get you mean if you're on a king-sized bed or something um and again I know some people they're just like there's no chance but if you want to know the the cost for your like the your relationship just lose your use your loved one ideally please don't please don't don't oh my goodness so um the only last thing I want to mention

02:14:26 here is something that's popped up just a few times recently but you're going to see more of um which is called orthosomnia U so that is a term that is people are growing concerned over uh which is wearables and sleep trackers causing sleep issues so people be basically become too obsessed with optimizing maximizing scores and that alone well actually it's actually you so you learn when to wake up and so so you have actually U an anticipatory response when many hours prior to waking up so if you actually learn to have a little bit

02:14:58 of a what's that little molecule of like excitement and reward oh dopamine that's the one if you start getting that because you wake up and you get super excited to check your score um or your phone it's the same thing if you check your phone or Twitter or whatever immediately in morning that'll actually start carving back your wakeup time because you start launching it so it can ruin sleep becoming too obsessed so what I'll say is if you're going to use a sleep tracker and you just like don't care you want to

02:15:23 check it and you have fun with it great but if like you are really really interested in it and you pay a lot of attention to it don't check your sleep score for at least the first 60 minutes after waking up and then you that should help you that's a great tool I think that um and piece of advice I think generally because I think a lot of people are waking up in the middle of the night checking their phone two or three times per night I'm kind of wondering why they're doing that and I'm guessing it's this anticipatory wakeup

02:15:48 circuit yeah you absolutely should use either your night mode or do not disturb or airplane mode or something overnight or leave it out of the room yeah I mean if you have to wake up and like some people have um like a family member who's maybe not in great health and so they have to keep their phone around in case they call or things like that so I get it you're like I can't leave it out leave it in there leave it in do not disturb and enter in their phone number or whoever's phone number so only they

02:16:12 can get through but keep it black and white so if you do have to look at your phone at night you see black and white and you do not have notifications so make sure that there's no notification for no email and a no DM like get all that stuff off your screen and so you look at the did anybody call did anybody text of importance um what time is it no emergency going on black and white okay right back to sleep so that can help a little bit one of the supplements that I found is extremely useful for being able

02:16:39 to fall back asleep if I've woken up in the middle of the night and for some reason can't um and is also very effective for enhancing sleep when one is ingesting fewer carbohydrates m an issue that a lot of people run into um or for people that are fasting for many hours before sleep you know people are trying to not eat anything within you know two to four hours but is inositol 900 milligrams of myoinositol i i find again this is anic data to be clear if I wake up in the middle of the night and

02:17:11 I've taken 900 milligrams of vosl before initially falling asleep that I fall back asleep much more easily so that's why I've added 900 milligrams of inositol to my called Sleep stack I've

also tried just taking it alone and it works well alone but works better of course with the mag 3 and 8 um apogen and cleaning sleep stack the um the also in terms of tools for Sleep the the app revery that was developed by my colleague Dr David Spiegel who's a medical doctor at Stanford Psychiatry Stanford School of Medicine Psychiatry

02:17:43 um there is a free trial there's a nominal cost if you use it um month to month but the data are really strong that people that use that I think it's 8 to 11 minute sleep hypnosis once a week and it doesn't have to be in the middle of the night when you wake up really helps improve people's um ability to fall asleep quickly stay asleep fall back asleep if they wake up in the middle of the night in some cases curing insomnia in other cases really just helping people with their General sleep issues and I mention this because uh

02:18:13 obviously it's a technology it's not a supplement but I know that some people are supplement averse also if you look at by at the cost comparison between taking the Sleep stack totally um and the revery app it's Pennies on the dollar really um so again I'm a proponent of both for myself but I realize that people have varying budgets and again I should say as always behavioral tools first and I I think of the Ry app as as a more or less a behavioral tool yeah it's uh it's really just a tool any of these breath work

02:18:45 protocols hypnosis protocols they're just a tool for you to in touch back in with your own physiology rather than a a substance that's coming in so I I fully support those we have used a number of those um in in protocols there's some other tricks that we can pull in those areas um I probably shouldn't say this but the reality of it is depending on what's keeping you up um sometimes we recommend just getting up and getting it done uh like if it's a really like if it's a a project or a thing or whatever um like sometimes

02:19:19 rather than laying there all night not sleeping you can get up get it done and then if you stay awake fine at least the anxiety is gone or sometimes you can actually go back to sleep cuz you're like especially if the task only literally would take like 10 or 15 minutes um it may ruin your sleep but you're you're going to have ruined sleep anyways so you can try that tool um you don't want to pull that card very often and you have to have be very careful with what you consider to be something worthy of doing that um but that is like

02:19:46 between me and you and nobody else here that's a tool I have used personally more than a few times where just like I get an idea and I don't lose it or like the solution for something you've been noodling on for a long time Pops in your head and just like and you're not wanting to forget it just get up and get it done and get on with your day in several previous episodes you emphasized how exercise induces various adaptations depending on the type specificity volume intensity Etc of the exercise and that

02:20:14 during exercise the degree of adaptation that one triggers is often associated with things that normally we don't associate with exercise related health things like huge increases in blood pressure during exercise huge increases in inflammatory markers muscle damage and these all things all sound terrible but as you beautifully explained all of that triggers adaptations that then bring those markers below the Baseline with which they were previous to the exercise so that's the adaptation and the

02:20:48 recovery within the realm of supplementation and nutrition I'm aware of a number of things some herbal some lipid based other compounds that are used for various things but that are known to have a potent anti-inflammatory effect things like omega-3 fatty acids ashwagandha for its effect on cortisol although that's a bit indirect to the inflammatory pathway um curcumin uh and things of that sort given that we want inflammation in order to trigger the adaptation response to exercise and given that we want to

02:21:26 reduce inflammation in the recovery period can we put together a logical framework as to when is best to take anything anti-inflammatory whether it's supplement base or prescription or over the counter drug and when to strictly avoid taking any anti-inflammatory supplement or um behavioral tool you mentioned ice can reduce inflammation that's why you don't want to do it too close to exercise anyway I think think you get the gist of the question what about specific supplements related to inflammation and

02:21:56 anti-inflammatory responses what are the best ones when should we take them when should we avoid taking them the way that I think about it is understanding what we call the fitness fatigue model so what I mean by that is whenever you do some sort of insult the whole idea is for you to come back and get an adaptation now recovery is not adaptation right recover is recovery adaptation is what happens after you're recovered right so there's a very important distinction there Fitness fatigue model says basically you've done

02:22:22 something and you've got an adaptation and you've enhanced Fitness and by Fitness in this case I mean it as a non-specific term so you got stronger you've uh improved your endurance like whatever thing you're trying to train for at the same time though your fatigue elevated so what happens is if Fitness increases at the same or similar rate as fatigue your performance actually isn't any better and so you may think oh my program isn't working I need to then train harder or need to take more anti-inflammatory or whatever the things

02:22:53 are when in reality all you really need to do is reduce fatigue and if you do that your performance will increase and all the training adaptations will be actualized so the way that we do

that is a couple of things first and foremost is actually a taper so the the first step I think of if someone is training very very hard and you're not seeing any results and we want to think about supplementation before I get there I want to think about taper and D Lo if you're actually training hard and sleep

02:23:20 and everything else is taken care of so just without going too far into taper some general General parameters there um you want to think about about a 50% reduction in training volume over the course of about a week for every eight weeks of training super super rough right so if you've been training hard for three months for something you might want to taper for two weeks something like that right it's sort of a rough estimate that taper you actually don't need to reduce intensity because intensity is not the driver

02:23:53 fatigue it tends to be volume so as long as your volume is reduced by 50% you can maintain intensity you can maintain in fact I generally would recommend maintaining frequency so if you're used to working out four days a week keep it four days a week you can go down a little bit in frequency but if you go down too much in frequency you actually tend to feel super lethargic so I wouldn't do that if you do those things correctly you can typically see somewhere between like a 3 to 8% Improvement of performance um within a

02:24:19 matter of days so so it's important to do that um we actually ran a study on cross country Runners years ago testing on a metabolic cart um muscle biopsies blow a whole bunch of things and we did it pre and post three weeks of taper and we actually this is cool because we did this in competitive season so this were Collegiate cross country Runners and we got them to come to our lab three weeks before their conference Championship ran them all through a bunch of testing biopsied them they went through their

02:24:45 three-week taper and then we biopsied them again and then they went and ran um their conference championships and stuff well what happened was they end up hitting about a 50% reduction because what they did is they took out what we call the junk volume so they kept their race tempos high intensity stuff in there um they kept the recovery stuff and that Medium Pace they just basically reduced now they were terrified as any endurance Runner or endurance athlete or participant would understand um when you

02:25:11 take volume away they tend to get very nervous and so they didn't like that um but as a result of that what we saw is their V2 Max despite the fact that they covered half the mileage their V2 Max did not go down in 3 weeks of reduced taper your Fitness is in is extremely stable and in fact once we actually looked at their data the enzymes in their muscle were responsible for oxidative metabolism were maintained and so you don't have to worry about losing uh Again Fitness or we're talking about overall performance or even um

02:25:42 oxygen capacity mitochondrial function Etc that was all preserved obviously we saw performance go up what was actually really interesting is we saw I think it was around a 10% increase in type 2 which are fast twitch muscle fiber size so we saw a 10% increase in fast switch fiber size at the end of 3 weeks of tapering now what you may think is like wow I guess tapering is anabolic but that's probably not what happened what realistically probably happened was their volume of training was actually

02:26:15 causing their fibers to be reduced in size and then once we remove that fatigue they just recovered back to normal so that's a good example of what I'm talking about once you remove the fatigue you can actually see enhancements and performance not because you're necessarily getting better but because you're removing the simul light light suppressing you so that being said the way that you want to think about recovery like this is although recovery especially like injury recovery like seems chaotic biology is very organized

02:26:44 and there's a very specific three-step process that you're going to go through for recovery and then there are different supplements that can help you in each of those three areas so area one is basically inflammation so this is when the cyto storm comes rolling out uh it starts signaling the injuries there in this case even if it's muscle damage um and activates immune system to kick on and that whole repair process happens there um what you're trying to do effectively in fact this is why you

02:27:12 probably ever wondered like why is inflammation a thing um what you're trying to do is bring in fluid enhance the size and increase blood flow in so you can get nutrients for repair and immune cells and everything like that in the system and get the waste out so short-term inflammation even in the case of muscle soreness is the example we talked about in the previous episode but any inflammation it is part of the necessary process that's why you would not want to take an anti-inflammatory in

02:27:38 that state and so why you also would not want to do things like an ice spat um so in that immediate inflammatory response time window this is you know seconds to hours after training you would want to stay away from things like that um a good option here are things like Omega-3s um good evidence some somewhere in the neighborhood of like 2 to 5 GRS total typically like a 1:1 um EPA to DHA ratio is fine similarly this is another example of when good doesn't mean more is better um because for example there

02:28:11 is EV actually evidence showing up to 15 grams will harm the immune response and so you don't just want to be like man I'm super sore I'm training harder I'm just going to go to 10

grams a day or more and more more you're actually causing yourself more of a problem um so antioxidants anti-inflammatories are fine again Omega-3s in that dosage um are a decent thing um you can also do something like 500 milligrams of curcumin three times a day that's going to be enough uh to keep you in a decent spot um there are some other things that

02:28:40 you could look up um maybe some potential benefit for ginger um and bellia and some things like that for inflammation but under unless we're in like very specific circumstances where we have like an injury we're probably not going to those you know areas I just wanted to highlight one thing that came up in a previous episode some not all people but some including myself are very sensitive to kirkum Y it has a very potent effect in reducing DHT dehydrotestosterone and leads to all sorts of uh clamping of

02:29:12 testosterone Associated positive things so um I have experienced that myself I've had people write to me and say I don't understand I started taking the supplement um Kirin is supposed to be a great anti-inflammatory it flatlined my libido it took away my drive um and kind of wondering what's going on there those people are very likely to be very DHT sensitive circumin while it's a potent anti-inflammatory can also potently reduce DHD but some people tolerate it quite well and are hearing this and

02:29:42 probably think that's ridiculous well it's U certainly substantiated by the biochemical Pathways that kiriman Taps into in the known roles of DHT on libido aggression power output Etc and mood so just be wary that um a there's no way to predict this one simply has to figure it out empirically meaning you have to try and see if you like it or don't um the good news is is those um negative effects on DHD seem to reverse pretty quickly after um ceasing to take uh circumin so just a mention of something

02:30:13 that came up in a previous episode but in case people didn't hear that on that segment um just wanted to highlight those those facts further evid do I I strongly discourage strongly discourage taking anything in the anti-inflammatory antioxidant realm unless you actually have a reason to do so um if you're waking up and you're like maybe I'm inflamed that's probably not a good approach let's have a reason to do so step two is actually what we call proliferation and that's kind of like the cleanup crew that's when you're

02:30:41 going to be going in there and cleaning out dead cells and debris and misfolded proteins and things like that at this stage a fantastic evidence based supplement uh is glutamine glutamine 20 gram a day we typically honestly split it up into two dosage 10 grams morning 10 grams night it's a conditional amuno acid which means you can make it uh your body can make enough of it at times and other times you may want to support it uh generally those conditional times are things like burn victims um high stress

02:31:09 situations or injury things like that so um there isn't also like a ton of downside to glutamine because it can go through uh transamination which means your body can take it and say like we don't need anything here for our Muscle Recovery let's make it into something else and use it um for whatever else is needing so it's kind of another one of these like lowrisk uh products it's hon why you see it in a lot of recovery products um if you're ever wondering like what the heck is that in there I don't need amino

02:31:40 acids and you're thinking it's like for protein synthesis it's really not it's because of this it is uh beneficial to this proliferation process I've been taking glutamine for years um I tend to take it in higher dosages several times throughout the day if I'm ever feeling particularly run down y I know they're decent data not great but decent data on the role of glutamine for leaky gut totally for offs saying leaky gut that's getting a little bit into the realm of uh like not super well substantiated but

02:32:10 in the in the peer-reviewed literature but some a lot of anec data and um and certainly some peer-reviewed work but not a ton and then there is also um grown interest in the idea that glutamine because it can trigger activation of the neurons in the gut that signal to the dopamine pathway in the brain that it can be used to offset sugar Cravings this is kind of an interesting new uh and emerging theme which makes sense given the biology of the neurons in the gut that respond to uh specific amino acids including

02:32:40 glutamine essential fatty acids and sugar and because they respond to any uh and all three of those um any one or combination of those I should say um to trigger this dopamine response some people have taken to uh a teaspoon or so of glut of glutamine in some water or other drink couple times throughout the day as a way to reduce their sugar Cravings because what's essentially doing is it's tricking the pathway into into activation of those neurons through an alternate uh ligan receptor interaction right also another

02:33:11 interesting point there are very I'm trying to think right now at the top of my head I can't think of a time and I've used glutamine a lot I can't think of a time where I've ever heard anybody come back with any side effect reports I think if you take enough of it you can get some gastric distress but of course you take enough of any powdered substance uh mix in water you're going to get a a gastric distress response and I what I've noticed about gastric distress with things like uh creatine glutamine and

02:33:40 even protein powders for that matter I use a high quality uh whey protein powder routinely um is that if you build up to it over the course of a few days then can get away with using

much higher dosages without any issue yeah yeah um beta alanine is the same thing by the way we sort of talked about that earlier if uh you've ever tried that and you're like oh my gosh like I feel like I've just rolled around in grass and my skin is itching everywhere it's that ants under the skin sensation yeah all that

02:34:07 stuff um you can just take a little bit of a lower dosage and be fine for the most part and then you will build up a tolerance to that pretty quickly so you can up that dosage along the way so what we will often times do there is start at a dosage that's pretty minimal like 2 grams um and then every week or so you can go up another gram until you get to whatever final point you want to be five six grams day you know whatever um so that's another way you can sort of mitigate that problem so the third step

02:34:33 in this recovery process um after inflammation proliferation we're now into Remodeling and this is when you're actually you know quote unquote growing back bigger and stronger um this is where the majority of the repair is actually taking place and at this point we're basically playing a micronutrient and macronutrient game right by that I mean talked about basic macronutrients um one thing to pay attention to often times if people are hurt whether they had an injury or they've had uh just they're super sore and they are

02:35:03 concerned about eating excess calories they tend to want to eat less food during this process because they're like I'm not working out so much so I'm going to eat less calories one of the things that you have to pay attention to is injury can increase basal metabolic rate by up to 10% wow so what you want to do in general is just take your calories up about 10% at least that's what I recommend um if that is an extended period of time then yes you may put on a slight amount of body fat or something

02:35:31 but if that also means you come back some percentage faster then it's worth the exchange um so we recommend that in terms of your carbohydrate or fat split I'm not super worried about it my general recommendation is just don't make any major changes relative to what you were doing right keep yourself uh pretty much in in the same spot in terms of protein this is the big one you want to make sure you were absolutely at 1 G per pound of body weight because we need those amino acids to come in and start

02:35:59 helping um with recovery one gram uh of protein per pound of body weight or more or one gram or more yeah there's going to be very little downside to having more um remember protein and carbohydrates both stimulate insulin and remember insulin is anabolic and so we're trying to drive this process of recovery um that's why you want both so you wouldn't want to skimp on carbohydrates in this phase nor would you want to skimp on protein because you need the activation the drive into the tissue as well as the

02:36:32 structure going back to one of our earlier conversations and at this point in the week I honestly can't remember at all what episode we covered this in but I gave an analogy about um use making a campfire and using fat and carbohydrates is the wood and the log and the protein worry the metal structure so you need that Supply if you're trying to B if you've cleared out in the previous step um damaged proteins and you need to make new ones to recover that process you have to have the raw Supply and material

02:37:01 so you wouldn't want to avoid either one of those things um there's actually some indirect inflammation management that comes from fatty acids which you actually sort of alluded to earlier um I don't think you need to necessarily go crazy you don't need to change your fat intake that much just don't drop it you know depending on where you're at so if you're a little bit of a higher carb lower fat person great great if you're moderate great if you're the indirect if you're higher fat lower carb person

02:37:24 awesome just don't make an extreme change and don't and try to not be on the extremes of either one of those ratios but the only specific number to pay attention to again is that protein number and if you go a little bit high or even a lot high it's totally fine just don't go low so that's the macronutrient portion of remodeling in terms of micronutrients to be honest you just get your bases covered uh this is when a basic multivitamin uh is effective what you're really trying to look at here are vitamin A and zinc they

02:37:54 actually have independent mechanisms that are helpful here but those are typically covered in most multivitamins so we generally just give people a multivitamin U magnesium is actually has some some benefits here something like 6 milligrams per kilogram of body weight is the dosage you're looking for there um magnesium citrate is probably has the most evidence uh in terms of this respect but it doesn't mean I actually have no reason to think you couldn't use glycinate or if you're using another

02:38:22 form for Sleep um that probably fine I don't know that for sure but I I can't think of a reason why the other forms of magnesium would all of a sudden not work so you could probably choose whichever form you like um OB citrate has probably the most research in this aspect the only other things you would probably consider here uh three things um calcium might be on your list particularly if you're trying to if you're concerned with some sort of bone injury that we've sort of got gone past like recovery and

02:38:51 we're actually like into injury um so you'll see that in recovery products occasionally and that's why uh and then the last two ones of course are vitamin D and that's pretty well

researched uh and then the last one is actually uh something that can help you if you're at this stage and you still are dealing with a lot of soreness or not and that is tart cherry juice that's actually effective for both THS muscle injury muscle soreness and actually has another benefit of potentially aiding with sleep

02:39:17 so not a bad one to turn to as well 's a number of companies that make these things um yeah and then there's actually more ongoing research that I know of on those areas but uh promising literature will'll say not often but every once in a while on this podcast I will solicit social media for questions from the audience where I should say the audience to be and then ask some of those questions on the fly during the podcast I did this with Dr Lex Friedman I'm going to do it with you your goal is to

02:39:49 answer each of these questions certainly not all of them thousands of them within the last couple of hours to answer each of these questions in three or four sentences I certainly won't be counting the number of sentences that you speak so just know that if you want to go over a little bit that's fine but feel free to refer to your Instagram site at a future time where you might go more in depth or to refer to a study or um if you like you can also say pass if you don't think that you can answer the

02:40:18 question um assistant ly enough for this format and here the goal is not to put you on the spot um the goal is simply to allow the audience to ask some questions directly and I confess I'm looking at these for the first time uh so I'll try and be quick with my reading um some of these we may have touched on in previous episodes or in this episode even in which case you can just kind of cue us to the reminder this is not directly related to supplementation but it is related to nutrition and I don't think we touched

02:40:48 on this directly can we do intermittent fasting AKA time restricted feeding with keto and still gain muscle mass TBD I am am quite clear such study does not exist so I don't know I think I've alluded to to before that we did run an intermittent fasting 168 hypertrophy study there was no keto arm uh the results of that study by the time this comes out will probably be ready though I'm not sure so I can't comment I not have the data but regarding whether or not if you did that with keto or not I can't comment

02:41:26 scientifically do you ever prescribe the use of Gaba supplements well I can't prescribe anything to to make sure we're clear but you're Professor you can profess I can profess uh we generally don't spend too much time on Gaba rarely is it okay to weight train fasted than not break the fast and eat for three or four hours after training so in other words y train fasted I do this but then also not eat immediately following training and wait another three to four hours after training once we have our results from

02:41:58 our intermittent fasting study back we will we will have a better answer here my general recommendation as it stands now though is as long as your total protein intake is sufficient um you should be in a decent Spot Great a lot of questions about fasting and training just to to note that um can you train high performance fasted and how long before um you need to refuel the body yeah you can certainly do that I know of actually many athletes uh some athletes that will do that though the vast majority will

02:42:30 not uh as it gets higher and higher in intensity and or duration it gets more challenging but it really does come down to what you did the day before as well so if you ate sufficient calories the day before uh didn't train and your glycogen stores are topped off you have a fighting chance now the duration part of that equation is really kind of dependent upon you um so are you really talking 30 45 minutes 60 Minutes you're probably fine whether you're out past that in several hours you may not be and

02:42:59 then the only other comment I would make is there is keep in mind whenever you think about fasting and any other let's say against the textbook you know quote unquote St style you really really need to be careful and thinking the difference between can I do it and is it optimal so I have absolutely no reason to think fasting like that would improve improve performance I only work for the most part with people who are trying to perform at the highest level possible so I can't think of a scenario in which I

02:43:27 would go too fasting to try to enhance performance so whether or not you can maintain some level of performance probably um will it provide any benefit I struggle to find scenarios in which that would actually make you perform better how do different forms of carbohydrates impact performance and then right below it another question about carbohydrates which is does carbohydrate cycling work so these are two uh questions from people that I think don't know one another but a lot of carbo questions about carbohydrates and

02:43:55 performance which we've touched on anything else that you want to add to that conversation I don't think I really maybe you might want to think about carb loading uh SL carb cycling so carbohydrate loading does help uh however a misconception there is it's just you know a big bowl of pasta the night before that can help top off storage but really optimal carbohydrate loading prior to a long duration endurance performance is probably best over the course of three or four days so you want to gradually increase

02:44:26 carbohydrate intake for multiple days rather than just have one big bowl of pasta Branch chain amino acids and essential amino acid supplementation yay nay or as I would say meh

uh meh usually if your total protein intake is fine then you don't really have a need for them um if you're for whatever any number of valid reasons total protein is not then going to an essential amino acid would be my first step rather than a BCA um now admittedly we actually do use essential amino acids somewhat regularly because it's it's

02:45:04 also sort of like a there's no real harm other than if you're price conscious and you're sort of like I'm wasting money that's fine the people I work with generally again that's not a few dollars for to maximize recoveries is not that big so we will sometimes use that uh premit or post training in in some circumstances uh total protein would be high quality way something like that um if you can't use whey for whatever reason there are plenty of high quality vegan proteins you could use if you want

02:45:34 to top all that off though and add some essential amino acids it wouldn't hurt anything and may potentially help slightly so you choose um based on that algorithm ah I was hoping somebody would ask this we touched on it a little bit it's a a little bit of a loaded question the way they phrased it so um at risk of leading the witness does the mythical anabolic window really exist and I'm just laughing because the way they pose the question they're already telling us what their stance is um making it more effective as to create

02:46:05 hypertrophy uh to eat within a certain time frame after working out I'm going to assume that this person genuinely wants to know whether or not the anabolic window really exists or not um because they refer to it as mythical I'm going to assume that they're um suspicious but what's the deal is the anabolic window a real thing the post exercise anabolic window is extremely real so what this is uh you can see more detail in a number of videos on my YouTube page I believe it is the idea that you need to must uh consume some

02:46:37 sort of nutrients specifically usually protein uh in some time domain 30 or 60 Minutes post exercise in order to maximize growth so is that window real yes are you hyper sensitized to nutrients in that time frame yes is it very important that you rehydrate uh replenish muscle glycogen and rebuild tissue quickly after exercise to maximize recovery absolutely it's not real though in the sense that you that you have to have it within 30 minutes um in the case of protein as we talked about a second ago your total protein

02:47:09 intake throughout the day is more important um timing though for things like carbohydrate especially if you're training multiple times a day it is very real so it is a very real thing it's just you may or may not actually care about it it may not be important for your context garlic seems like an appropriate question what if any functional roles does garlic have in performance Garlic's actually really cool there's a number of things you can dive into that are outside of my three to four sentences considering them at

02:47:39 like two and a half probably already um you're not going to find strong human data on garlic extract however there is a little bit uh suggesting it can actually enhance hands recovery from injury or potentially tissue damage so you got to kind of be careful though because in order to understand what's happening you have to differentiate between innate and adaptive recovery processes and when we say things like immunity realiz defense that's not one thing that's just like a very colloquial term for a number of things again it's a

02:48:10 verb like it's a noun right the immune system but it immunity is a bunch of processes or processes if you're about to correct my speech I'll correct your right back um not yours Andy but the listeners process tomato tomato it's a verb immunity is a verb this is my problem with immune boosters same issue right you're like whoa what are you boosting specifically because in fact if you're boosting the wrong part of immunity during the wrong phase of recovery with garlic you may be actually hurting uh the the process

02:48:45 because you were theoretically could be trying to downregulate that ption that you can upregulate a next portion that's the faster way to say it if you will so um we actually you may see more data come out that says the garlic extracts now overrated I don't know I actually don't even know yet we just don't have enough human data on it but yeah there's some stuff there if you want to look hard enough I'm gonna ask this question for myself because I'm curious to know the answer selfish tart cherry extract uh

02:49:14 pretty effective actually uh for two things uh potentially ating and sleep getting to sleep as well as muscle soreness that's the bulk of the research is in muscle soreness and um seems to be a moderate effect there I think for people that might be interested in dosages of things like tart cherry extract garlic Etc um obviously Dr Andy galpin's Instagram and Twitter are great places to ask questions like that and to find qu answers to questions like that as well as examine.com is a terrific website um they actually recently

02:49:47 overhauled their entire website so they have this human effect Matrix that shows the um the effects and the the strength of different effects in human studies of many many different compounds um relating to everything to you know Hormone Health in men and women sports performance cognitive performance it doesn't cover everything but it certainly covers a lot with links to studies there's a lot that's available at completely zero cost by joining examine.com um you can access some addition features and this is by the way

02:50:21 not a paid endorsement from examine.com I'm simply a longtime user of examine.com myself um and so I just want cue people to it and again many of the resources there

are available completely free of cost It's a Wonderful site um so for dosages of garlic tart cherry extract and things of that sort whether or not you're getting it from food or you're getting it from extract uh powders rather um all of that information is is pretty nicely laid out there so unless you have something to add to that I was just going to um cue

02:50:50 people to that resource no I've been using that since the first day that website was launched I I was made aware that it was coming I've been fortunate to know those guys for a while so yeah I've used it I've used it in all my classes I use it I don't even know probably weekly at this point uh another NE nice feature that's actually on there is they have a a series of like they'll do some topical reviews basically so they'll write a big paper out on muscle damage or blood pressure or testosterone

02:51:19 en or um hormone uh you menstrual cycle and and yeah PCOS I think they do one on and all kinds of stuff so you can search by topic uh like you know energy or recovery or whatever or you can search by you know black human seed extractor like whatever number of things you want to do and they'll also tell you if there's any interactions to pay attention to so it's really really nice so be careful if you're taking a and b or whatever so yeah it's wonderful wonderful yeah they've done a marvelous job so thank you examine.com keep keep

02:51:49 up the amazing work well we've come close to the end of this episode and that means that we are close to the end of this series where you have so graciously joined us for six full episodes of The hubman Lab podcast to educate us on all things Fitness episode one you reviewed and educated us on assessing our level of Fitness in fact I learned so many ways of assessing Fitness that I had not thought about and also assessing my recovery capacity for instance one thing that I'm definitely going to implement from that episode is

02:52:26 a routine broad jump test and uh an inhome high jump jump and touch test if people don't know what I'm referring to that's all contained in that episode it's timestamped these are very straightforward zero cost ways to assess one's level of Fitness um there are few others that require a bare minimum of Technology like taking your pulse rate in very specific ways at specific time also some timing of Mile runs and some other things related to strength and hypertrophy and on and on really it's a it's a buffet of options that we can

02:53:00 select from and I already know the four or five that I started implementing this week I've recognized how I'm pretty good in a couple of areas I'm doing maybe maybe better than pretty well in one area but that I'm doing abysmally poorly in a few areas that um I just wasn't aware of and so I've already started um taking on ways to uh adjust that over time and I I'll keep people posted so that first episode was absolutely incredible and just provides so much actionable knowledge and the rationale behind it the second

02:53:33 episode you educated us about strength speed and hypertrophy training and there too an immense amount of incredible knowledge we got way down into the details you explained sets reps the rationale for sets reps rest Cadence number of workouts per week I'm definitely going to take away my need to do some speed Based training and some power-based training normally I think in terms of strength or hypertrophy and I'm relieved to learn that a lot of the speed and power-based training it it's low intensity enough

02:54:05 that it can be done fairly often and incorporated into my program which already touches on strength and hypertrophy and indeed some endurance work as well so amazing tips that you provided there I'm certainly going to implement the 3 to five program that you describ um 3 to five exercises done for 3 to five repetitions 3 to 5 minutes between sets uh you're doing this three to five times per week and so on and so forth all the details again timestamped um in the strength and high pervy uh episode show

02:54:36 note so just incredible we even use that to set up PR with you this week that's right I did PR this week thanks thanks to your input and following that program and um I'm really grateful for that it it does feel good to break through a barrier um and I intend to break through more barriers but not just with strengthen hypertrophy because episode 3 you taught us all about endurance the four different forms of endurance how to train for each of those different forms the value of doing even very brief 20

02:55:06 second Sprints or bouts of jumping jacks throughout the day which to some people might just sound like a you know like a little hack or gimick but no these are actually tapping into fuel systems and modes of neuromuscular interactions that great greatly Aid other forms of endurance like long duration endurance I would love to return to my um High School mile time I won't reveal what that is because this is not really about me but I plan to start doing um if not mile repeats then doing some mile mile

02:55:33 runs and testing there once a week you laid out a beautiful program for how to do that and then in the next episode you wowed us again with a description of the science and the tools and this right down to the details but all laid out very cleanly and clearly as to how to design an optimal fitness program what are the things that really represent an optimal program what questions does one have to answer before designing a program what are some of the barriers in the way this concept of Defenders as

02:56:06 things that prevent you from reaching your goals and one of the key things I have it right here in front of me um that I took away from that episode is was this quadrant um approach of

really thinking about and figuring out how much one intends to devote to work career calling let's make that one bin um relationships another bin Fitness in the other bin and Recovery in the other bin and um here we'll tip our hat to our our good friend Kenny Kane um for um mentioning that overall um scheme for doing things it's been immensely useful

02:56:37 and I've actually charted it out and thought about and drawn out which Different Things fall into each of these categories you might think it's obvious okay relationships but that includes a lot of different things and there's crossover between these bins um in terms of how you can combine enhancing relationships with Fitness work recovery and so on so that episode is just again a treasure Trove of knowledge and then in the next episode you you educated us on recovery in all its forms in the very

02:57:04 short term in within the workout immediately after the workout and from workout to workout ways to really accelerate recovery assess recovery and as you pointed out for people like me who always assume that we don't recover very well and that some sort of character trait or nervous system thing or genetic to really think about how my training is impacting my level of recovery and in doing so is revealed to me that I have far more capacity than I thought I had and already this week I've managed to train more often doing more

02:57:35 work and I feel better than ever um and that's also despite the fact that we've we spent a fair amount of time in these chairs across from one another it's a kind way to say it well it's it's been it's been a pleasure and then in today's episode you explained nutrition and supplementation as it relates to Performance and of course that touches into recovery but also optimal mental States for training how to approach one's training and how to extract the most from training through quality nutrition right so what to eat and when

02:58:07 which carbohydrates protein amounts Windows of opportunity um Windows you absolutely don't want to miss and then some that are a bit more flexible and then we went deep into the weeds of magnesium garlic tart cherry extract Alpha GPC we touched on neurotransmitter related systems hormone related systems we went deep into a discussion about sleep because of course sleep is the foundation for recovery and performance of all kinds emotional mental and physical recovery and performance and in taking us through this enormous Arc of a

02:58:40 journey through Fitness I think it's fair to say that you've given us your knowledge contained in your head I was telling someone uh just the other day that one of the things that I always lamented in science is that I would encounter these incredible professors and scientists and in other domains of life too and you just wish there was some way to download their brain because they had so much knowledge inside them and um I'm looking for a USB or USBC uh port on you and I don't see one yet but what you've

02:59:07 effectively done for us across these six episodes is to download the actionable knowledge and you know it's wonderful the information you've provided is clear it's super interesting it's highly highly actionable and in many cases it's counterintuitive and surprising but once one understands the logic behind it as you've provided for us also then it all makes sense in a way that's extremely satisfying and extremely motivating so it's certainly motivating me to change the way that I train in a number of ways

02:59:38 and I promise that I'll report back to our audience and to you as to what my results are but really as we both agree this is not about me this is not about you this is really about the people listening and so for those of you listening I uh hope you can appreciate what an Incredible Gift it is to have somebody of Dr Annie galpin's experience and um drive and uh scholarly background who also works with athletes in Everyday People just to splay out all this knowledge for us systematically over six

03:00:11 episodes Dr Andy Galpin thank you ever so much I appreciate that far too kind of uh words to me there if you've been following along through this entire Journey as you called it you know I like first principles thinking and I like lists so I'm going to get you with one more list and I got five things on this final list get your pen and pad out please uh number one I want to really emphasize science itself is a verb which means it's ongoing and changing I I did my best over the course of these many

03:00:45 many many hours to um provide my inter a of the science uh to provide my practical knowledge and things that I use uh but that's fallible uh science changes there are many many things in my career that I was very sure the that the evidence was clear on and then it changed so as you move forward do not think of any of the recommendations I gave you whether they were about supplement dosages and timing uh rep ranges or breathing tactics anything in between just use them as guidelines so number one science is a verb number two

03:01:24 I really want to thank the audience this has been an extremely long haul as some of you have somehow I'm sure which I'm not sure how but some of you have probably made it through this entire journey and listen to all six episodes and you should probably get some sort of free hubman lab shirt or something or a plaque or I don't know how about a Galpin plaque ah gin plaque how about a internet high five um and even if you just dropped in for a few of the episodes uh you know I I appreciate you taking the time there's a lot of things

03:01:50 you could be doing with your time and uh to make to spend those resources on my words is uh touching number three uh I want to actually thank you of course Andrew and the whole

team and the crew up here for three things number one um I think it's incredibly important that you have gone out of your way to give other people credit for their work you go out of your way on your large platforms of social media to tag people to give scientists credit for their work and most people do not do that uh and that's

03:02:20 something you don't have to do and I think that is a culture you know I know why you do you come from science that's just what you do you give people credit for their work but you go out of your way to do that and so I want to thank you for that the next one is many people who have outlets and platforms will try to fill those with people who are going to grow their platforms doesn't mean these people are wrong or bad but I think what's extremely special about what you've created here is again you have gone out

03:02:50 of your way to bring on the direct source of information um I can't even imagine how many of your podcasts guests have never been on a podcast before or been on a very short number of them and you've made an extremely large platform doing nothing but talking about super deep dork science directly from the scientists themselves U and to create a community like that it's um I'm so happy that science is is made it here and you've shown the world um people aren't stupid people want detail and people

03:03:20 want science and you've given it to them um and the last one of course let's see if I can get through this is uh thank you for what you've done for me in my career I I understand there could have been any number of people in this chair to put me on your your platform once was um incredibly gracious but to do it for 600 hours or whatever we did in this series is uh um I can't thank you enough for that opportunity so I hope I lived up to it and I had a tremendous time and and thank you for being such a gracious host well you more

03:03:52 than exceeded uh expectations you are absolutely the person to be in this chair talking about these topics with me and for the world and once again I just want to say thank you as a colleague as a public educator as an exercise scientist and as a friend if you're learning from and or enjoying this podcast please subscribe to our YouTube channel Channel that's a terrific zero cost way to support us in addition please subscribe to the podcast on Spotify and apple and on both Spotify and apple you can leave us up to a

03:04:27 five-star review if you have questions for us or comments or suggestions about topics you'd like us to cover or guests you'd like me to include on the hubman Lab podcast please put those in the comment section on YouTube we do read all the comments please also check out the sponsors mentioned at the beginning and during today's episode that's the best way to support this podcast I'd also like to inform you about the hubman Lab podcast free newsletter it's called the neural network newsletter and each month the neural

03:04:51 network newsletter is sent out and it contains summaries of podcast episodes specific protocols discussed on the hubman Lab podcast all in Fairly concise format and all completely zero cost you can sign up for the neural network newsletter by going to hubman lab.com go to the menu and click on newsletter you provide us your email we do not share it with anybody and as I mentioned before it's completely zero cost by going to hubman lab.com you can also go into the menu tab and go to newsletter and see

03:05:17 some example newsletters from months past thank you once again for joining me for today's discussion about fitness exercise and performance with Dr Andy Galpin and as always thank you for your interest in science [Music]

00:00:00 [Music] welcome to the hubman lab guest Series where I and an expert guest discuss science and science-based tools for everyday life I'm Andrew huberman and I'm a professor of neurobiology and Ophthalmology at Stanford School of Medicine today's episode is the fifth in a six episode series on fitness exercise and performance and today's episode is all about recovery that is how to maximize your recovery to achieve your fitness and exercise and performance goals and how to avoid overtraining Dr Andy Galpin great to be

00:00:31 back today we're discussing recovery and I'm very excited to have this discussion because as we know despite the fact that different types of exercise can be used to trigger different types of adaptation such as increased long distance endurance Anor robic capacity strength hypertrophy Etc the workouts themselves are not actually when the progress occurs when the adaptation occurs occurs and this to me is extremely interesting because it parallels what we see with so-call neuroplasticity which is the

00:01:07 nervous systems ability to change in response to experience we sit down to learn something we experience something and that is the trigger for rewiring of the nervous system but the actual rewiring occurs away from the experience or the learning so to in Fitness and in exercise recovery is where the Real Results actually emerge where we get better so I'd love for you to explain what recovery really is and the different types of recovery certainly different ways to enhance recovery and I'd also love for you to explain whether

00:01:45 or not there are ways that people can become better at recovering because if indeed recovery is when progress emerges when we get better well then anything that supports our recovery and gets us better at recovering ought to increase our rate and our degree of progress absolutely you nailed it in the description what people really want is some sort of change whether we're talking athletes or general population this change is uh some sort of improvement in muscle function reduction in body fat higher functioning

00:02:17 metabolism whatever the case is and the only way that happens is we talk about the equation of stress causes adaptation but as you alluded to the piece in the middle is only if you can recover from it and so the game we're playing here is we all agree we want more adaptation that means we need to bring more stress into the system but we then have to ensure that our recovery outpaces the stress input or else we no adaptation will occur in fact what happens is you will actually be in a negative spot and start going backwards

00:02:46 and so what I would love to do is talk about how we've handled this um and I've had a decent amount of experience here I was fortunate enough to do my master's degree in the laboratory of a gentleman named Andy Fry who's an NCA Lifetime Achievement Award winner and he studied in large part recovery overtraining overuse overload in a lot of areas in addition I've been fortunate enough to work with individuals from high functioning CEOs and Executives who have little time for Recovery High job

00:03:18 stress to athletes uh in the think of the example of pitchers in Major League Baseball who have to recover in a matter of 4 days so that they can pitch again at maximum velocity so I would love to outline some of the tools and tactics strategies that we use for all these individuals um give you some foundational stuff and I would love to maybe actually cover some things that most people have never heard of um some stuff you may not have access to some technologies that we use some biomarkers um and then even a whole

00:03:48 bunch of things that are keeping with the theme of your show here cost free or extremely low cost so all those strategies um what I would also like to do is cover nutrition and supplementation and fueling and hydration and things but that's probably going to have to be saved for an additional conversation that we'll do in the next episode yes so we will absolutely hold a conversation about nutrition and supplementation where you can educate us about all the top C toour stuff all the way down to

00:04:15 the the uh fine details I do have a question about recovery and it's one that I think most people are familiar with themselves which is soreness we think of it as muscle soreness but I was trained early on in my scientific career to always question the seemingly obvious so couple of questions about soreness first of all what does soreness really reflect is it really muscle soreness it feels like it's in the muscles uh but what other organ systems and tissues and cell types does it involve and then I'm

00:04:51 particularly interested in this concept or this experience that many of us including myself had which is delayed onset muscle soreness why would it be that when we are less in shape

or when we perform a movement that is extremely novel to us the soreness seems to arrive after a reasonable delay of maybe even a day you know we're F the next day with 48 hours later we are exceedingly sore and as we get more fit or more familiar with the movement the soreness seems to arrive earlier so I realized I just

00:05:24 asked you about three questions or more first of all what is muscle soreness at a Cellular level which cells which organ systems and so forth what does it mean if we are sore is something I know we'll get into a little bit later and then why the delayed onset muscle soreness it's actually one question so it's totally fine you answered all you asked all three because I'm going to actually answer number three which will answer number two which will actually answer number one I'd love to tell you that I

00:05:50 set it up uh that way intentionally but uh I'm just happy to hear that where I was unable to be concise you are able to be concise thank you yeah we are still learning a lot about this area it's actually really difficult to perform these studies anytime you ask a question about something like pain or soreness you're immediately talking about perception and there is obviously a physical component to that but there's also perception and so teasing those things out is extraordinarily challenging that said there has been a

00:06:20 lot of work in this area in fact probably you may have a show already out on pain or maybe one's coming down the road we did an episode on pain uh while ago but it's definitely time to revisit that literature I also have some amazing colleagues at Stanford who work on pain both from the uh cellular and molecular side but also from the psychological side about how our um understanding of pain and what we believe about pain shapes the experience of pain and Pain Relief amazing that's that stuff is

00:06:50 incredibly important and I'm I'm glad we flagged that and maybe we'll just call that good for now they can come back later for another one of your shows so that being said why does it happen uh 28 to 48 hours after you exercise well that actually should give you some Clues into what's happening so the traditional dogma of delayed onset muscle soreness is what this is called is that it is a result of quote unquote micro tears in the muscle and so you can sort of think I challenged the muscle there was some

00:07:18 small tears in there and I'm feeling the result of that well in fact that certainly does happen and it can happen that is not what's explaining your muscle soreness and in fact you can be quite sore from exercise and have no measurable amount of muscle damage and so much like anything else when we're in this idea of pain it's not a onetoone explanation there are multiple factors that are probably causing your perception of pain muscle damage can be one of them it is not the only one and it is probably in my opinion though this

00:07:54 is yet to be shown definitively probably not even the leading cause of it and so what's actually happening well the reason it's taking you 24 to 48 hours is is you can actually uh find various papers uh literature reviews dating back in a number of years now over a decade that show these wonderful curves of an inflammatory uh and immune response and and we don't need to necessarily go through the entire physiology right now but effectively what's happening is those things have a little bit of a time

00:08:21 delay and so some of those steps happen immediately like right when the exercise is there and then some of them are delayed six to 24 to 48 hours um if you know a little bit about this uh physiology it's you have a combination of neutrophils and macrophages and a bunch of things happening and this has a Time sequence so what happens is by the time we get to this 24 to 48 hour window now the muscle soreness kicks in which wait a minute if I if this was a result of my muscles being torn and that happened

00:08:52 immediately wouldn't that pain start immediately well the answer is it would and so that that is your first clue that that's not responsible for it when we look at that immune response and we see that that is actually Peak 24 to 48 hours later and then that's the same time the pain kicked in that's cluing you with the problem so we have this immune response happening in inflammation then all of a sudden we start getting fluid accumulation and now there are what are called nerve receptors and you're probably very obviously

00:09:17 you're very familiar with these and these are pain receptors what's actually interesting is we don't necessarily know a lot of information about how many pain receptors are in muscle they're not really in the belly in fact this is why I can perform my muscle biopsies and they don't really hurt you mean in the belly of the muscle correct yeah we do have pressure sensors though and so if you change the volume of the tissue you will respond to that very very quickly so by enhancing swelling in the actual

00:09:42 muscle that is immediately putting pressure on those pressure receptors if you will that's the signal so what's probably happening here and I just I just hate to give you another bone but a lot of delayed on some muscle soreness is probably just a neural feedback loop rather than it is actual MUSC damage yeah makes a lot of sense there's a lot of interactions between the um types of neurons that control touch sensation and pain sensation and itch sensation in fact a lot of people um kind of collapse

00:10:14 itch and pain together Pingo you know that's something it's painful and it itches is is a familiar thing for people mosquito bites and such um and of course there's the uh classic gate

theory of pain which uh people will be familiar with and then I'll explain why I'm explaining this um which is if you something hurts you know you Bonk your knee or you stub your toe we tend to grab that body part and try and rub it totally and that rubbing is not a coincidental thing it activates a set of uh touch sensors that are that respond

00:10:48 to kind of broad dull touch um and that actively inhibits through the release of an inhibitory neurotransmitter the fibers that control the pain signal so anytime we we rub a you know like a charlie horse our leg or we or we stub our toe and we you know we winse and then we grab the toe and we kind of like squeezing in a little bit that's actually deactivating or partially inactivating the the pain mechanism so the idea that uh a swelling response would then trigger a neural response that then then

00:11:21 would recruit the pain receptor response here I'm using broad broad brush um Strokes here to explain this um makes very good sense to me um now and only now that you've explained how this process works I can actually even add more to that so if you remember how muscles work so we have to have some sort of signal from the nervous system that has to actually go in and tell the muscle to contract well remember there a few episodes ago we covered the physiology here of what's called a motor unit okay well what I didn't explain to

00:11:54 are called muscle spindles and we have talked about proprioception in uh an episode of before as well but we never tied this picture together so let me walk you through that really quickly and it's going to tie this Loop in into a nice bow so what happens is um this motor unit is coming in from what's called an alpha motor unit and that's going to be innovating your muscle fibers and that's going to tell the muscle fibers to contract those are typically spread out throughout the uh all sides of the muscle in interior

00:12:24 exterior all over on the outside though there is another type of muscle called a muscle spindle now these are non contractile so they don't have that actin and myosin and they don't produce Force they are responsive they are proprioceptive so what that means is they sense stretch and this is why for example if you were to um stretch a hamstring stretch any muscle group it doesn't really matter or muscle its innate response is to fire back to close that distance and this is what keeps you from say if you're leaning to the right

00:12:53 um You can imagine that the example we give is if if you're standing on one foot and you start swaying to the right all right let's say you're standing on your right foot and this make this easier for folks and you start swaying to the right like you're going to fall on your right ear will hit the ground the inside of your right calf muscle will start being stretched the outside will start being compressed right so the stretch on the inside of the right calf muscle will sense that stretch and it

00:13:19 will respond by Contracting that pulls you back to the middle and stops you from falling that's proprioception and muscle spindles send stretch and tell you to contract the way that they work is through gamma motor neurons and so these are sensory things so what's happening is unlike when you tell your muscle to contract it goes Alpha to the muscle contract these muscle spindles work such that it is oh I've been stretched send signal back to some Central Point typically in the spinal cord and we don't actually want to go

00:13:48 all the way up to the brain we've got a time delay this is why these are subconscious autonomic right versus somatic so that gamma is going to go back to the central location and then come back through the Alpha motor neurons until it to contract so you have this wonderful mechanism of sensing stretch going back well one Theory that's been put forward regarding muscle damage is that the pressure is actually being applied to those nerve endings of the muscle spindles and that's actually responsible for the pain signal that's

00:14:20 going back and coming up to your brain and you're registering that as pain rather than it is actually in the the contractile units so the muscle fibers that that's a very intriguing idea uh because it would suggest that stretching muscles in order to alleviate soreness might be the exact incorrect thing to do yeah now I'm not saying that for sure for certain I'm just building off the mechanistic logic that we've laid out here yeah really that you've laid out here there's a more effective principle based on exactly that which is

00:14:53 this is generally why low-level movement is effective at reducing acute soreness because that's lowle contraction of the muscles antich and get tissue out and and get fluid out wow you're literally pumping it out of the the cell yes and in our previous episode where we were talking about programming or using the wi but let's be fair here where you were educating us including me um and the audience about different structures for programming exercise for specific adaptations Etc the month week year SC scales Etc we had

00:15:29 a brief um discussion about the fact that if one trains legs very hard with resistance training you know some heavy squatting or deadlifting it or and there's some soreness that often times doing some quote unquote lighter cardio or um some uh low impact work the next day or or any number of different things that involve um not high-intensity uh contractions of the muscles but that do require contractions of the muscles that it can alleviate soreness more quickly than if one were to Simply lie around and you know watch

00:16:02 Netflix or something yeah that's exactly right the um to go back just a little bit as well the if that's really the case um the question is like where is this inflammatory signal coming from

and while there's much to be learned there uh there is a little bit of information right now that suggests it's potentially coming from free radicals released from the mondra again that may or may not hold up as more research comes I'm not sure but but if you remember back to our uh conversation on endurance so we talked about the

00:16:33 electron transport chain and aerobic metabolism and regardless of whether or not you're getting energy from glycolysis or carbohydrates remember they have to be finished through aerobic metabolism so even if you're lifting weights and you're using carbs for your fuel you have got to finish that metabolism by running it into the mitochondria and Performing oxidated metabolism as a result of that that electron transport chain runs so theoretically if free radicals which is um which are hyperreactive oxygen

00:17:02 species basically they're oxygen molecules that are missing an electron so that they react to a lot of things they're the opposite of antioxidants by the way this is you know oxidant molecules with extra protons so they can balance the charge if those leak out that in of itself is going to be a massive inflammatory signal and that's probably what signals the cause of these neutrophils and macroasia and kicks off this entire Cascade again I believe we need more research there I need to look into it maybe it's more definitive than

00:17:29 I that I know um but that's probably what's happening potentially what's happening rather that causes that Cascade in Signal also um what you have is this combination of well if that's the case why am I not getting tremendous amount of muscle damage when I do more aerobic based exercise well because you don't have the mechanical tension pulling on the fibers that's actually causing damage to the cell wall that allows these free radicals to escape the mitochondria and the cell cell wall so that's the best we can postulate at this

00:18:01 moment as to why those things are happening and then why again low-level exercise tends to enhance uh even things like percussion um so using either instruments that put a low level of vibration into your leg or like pneumatic boots so you massage all these things are generally probably helping because they're moving that stuff out Adema most specifically so pressure comes off of those nerve endings in the muscle spindles and allows you to stop receiving that signal of pain despite the fact that you

00:18:33 didn't actually regenerate tissue at all yet fascinating and I think that beautifully frames where we're headed next which is to talk about all the different modes of recovery and how to accelerate them and perhaps even how to combine different forms of recovery in order to become better at recovering and in doing so make faster progress with Fitness before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford it is also separate from Dr Andy galpin's teaching and research

00:19:05 roles at Cal State Fullerton it is however part of our desire and effort to bring zero cost to Consumer information about science and science related tools to the general public in keeping with that theme we'd like to thank the sponsors of today's podcast our first sponsor is momentus momentus makes supplements of the absolute highest quality the hubman Lab podcast is proud to be partnering with momentus for several important reasons first of all as I mentioned their supplements are of extremely high quality second of all

00:19:32 their supplements are generally in single ingredient formulations if you're going to develop a supplementation protocol you're going to want to focus mainly on using single ingredient formulations with single ingredient formulations you can devise the most logical and effective and costeffective supplementation regimen for your goals in addition moment to supplement ship internationally and this is of course important because we realize that many of the hubman Lab podcast listeners reside outside the United States if

00:19:57 you'd like to try the various supplements mentioned on the hubman Lab podcast in particular supplements for Hormone Health for Sleep optimization for Focus as well as a number of other things including exercise recovery you can go to live momentus spelled ous so that's liv.com huberman today's episode is also brought To Us by element element is an electrolyte drink that contains the exact ratios of the electrolyte sodium magnesium and potassium to optimize cellular functioning for mental and physical performance most people

00:20:25 realize that hydration is key we need to ingest enough fluids in order to feel our best and perform our best but what most people do not realize is that the proper functioning of our cells and nerve cells neurons in particular requires that sodium magnesium and potassium be present in the correct ratios now of course people with prehypertension and hypertension need to be careful about their sodium intake but what a lot of people don't realize is that if you drink caffeine if you exercise and in particular if you're

00:20:52 following a very clean diet that is not a lot of processed foods which of course is a good thing chances are you're not getting enough sodium potassium and magnesium to optimize mental and physical performance element contains a science spack ratio of 1,000 milligram that's 1 gram of sodium 200 milligram of potassium and 60 milligram of magnesium and no sugar if you'd like to try element you can go to drink element that's LM nt.com huberman to get a free element sample pack with your purchase again that's drink element lm.com

00:21:24 huberman to claim a free sample pack today's episode is also brought To Us by eight sleep eight sleep makes Smart mattress covers with cooling Heating and sleep tracking capacity

I've been using an eight sleep mattress cover for about the last eight months and it has completely transformed my sleep I'm sleeping about the same amount but I'm sleeping far deeper and I'm now getting the proper ratios of so called rapid eye movement or REM sleep and slow wave sleep and waking up feeling far more recovered mentally and

00:21:50 physically the underlying mechanism for all that is very straightforward I've talked many times before on this podcast and elsewhere about the critical relationship between sleep and body temperature that is in order to fall asleep at night your body needs to drop by about 1 to 3° in terms of core body temperature and waking up involves a 1 to 3 degree increase in core body temperature with eight Sleep mattress covers you can adjust the temperature of your sleeping environment to be one temperature at the start of the night a

00:22:17 different temperature the middle of the night and a different temperature as you approach morning Each of which can place you into the optimal stages of sleep and have you waking up feeling more refreshed than ever if you'd like to try Aid sleep you can go to eight sleep.com huberman and check out their pod three cover and save \$150 at checkout eight sleep currently ships in the USA Canada United Kingdom select countries in the EU and Australia again that's eight sleep.com huberman to save

00:22:43 \$150 at checkout so to kick off this discussion about recovery and with the understanding that recovery is when the specific adaptations to exercise actually occur I'd love for you to share with us what happens or needs to happen during recovery in order for us to get better at anything endurance strength Etc but also how specific types of exercise stimuli and specific types of adaptations that we trigger so running a bit further lifting a bit more weight slowing the Cadence of a given movement

00:23:18 Etc how those specific types of triggers for adaptation relate to the specific or maybe similar types of recovery that are required for us to make progress us in one of our previous episodes we were talking about how the Harvard fatigue lab really identified this idea of homeostasis or at least sort of championed it for it and that's important because in all levels physiology wants to return to homeostasis so what happens in terms of adaptation is you've challenged it to a level that it realizes if it does not

00:23:50 make a change it will not be able to get back to the same level of homeostasis that's fundamentally what's happening that is recovery that process of taking an insult being temporarily reduced in functionality causing a change so that now we come back and get what we often call in sport performance super compensation all that really is doing though is bringing you to a new level of homeostasis effectively it is understanding if that same insult comes again I need to be able to make sure that that doesn't cause the same level

00:24:25 of disruption and so we raise the bar whether this is enhancing our ability to take the same level of mechanical tension on the muscle and not result in micro damage whether this is being able to take the same reduction in energy and not have that compromise sleep or anything it's really fundamentally changing so we can have a new level of homeostasis because it's presuming it's predicting that that same insult is going to come again down the road I want to clarify for people that when Dr galin says

00:24:59 insult while he may actually insult me um insult is the nerd speake terminology for some sort of damage inflicted to a tissue or system so um he's speaking about the insult to the muscle or insult to the neuromuscular connection created by adding more weight to the bar um running a further distance um uh running a bit fast or or pedaling faster that creates a micro insult or an insult and now because everyone is familiar with um psychological and verbal insults you'll never forget that biological concept

00:25:34 it's important we tag another thing here which is called hormesis it's one of my favorite phenomenon and it effectively means this that there is a dosage or toxicity response to almost everything and if you think about this in the context of say drugs what this means is if I gave you 10 milligrams of something that it would be okay but if I gave you 20 it'd be a problem and eventually if I go up and give you enough this thing turns toxic this is a case of everything from cyanide uh where it can actually be

00:26:03 in small dosages in nature in fact it's in many of the fruits that you eat but it's at a dosage that it doesn't matter if that dosage gets higher though that actually can cause problems and if it is high enough it can actually kill you instantaneously the back end of that though is because you introduce this micro insult as you framed it for me perfectly your body will then adapt to it and that's really what's happening with exercise adaptation is is it is a hormetic stressor and why that's important is if you look

00:26:32 at the immediate responses to exercise you see an extremely large increase in inflammation you see oxidative stress you see a whole Cascade of autophagy like all these problems quote unquote happening it's that what's actually quite funny here is um as a part of my PhD the academic portion I had to go through the medical side of the school and so I was my physiology class was in med school so I'm the only non-medical doctor in that class right I'm a PhD some I leave my lab I walk across campus and I take physiology class with these

00:27:02 folks and I I died the whole time internally because every time we would cover a new area it was basically the the exact same value or number in a medical setting is like oh my gosh

they're going to die and in performance setting is like this person's in fantastic shape it's I never still amuses me to this day obviously because it's just simple things like total blood volume right and you cover like okay if you have a patient come in their blood volume is six liters you know immediately get them on a diuretic of

00:27:33 some sort because they're going to have a heart attack as blood pressure gets up right now I'm immediately thinking damn six liters that that person is super fit because that is actually a positive adaptation to training it's one of the most important if not the most important adaptation to endurance training is enhance total blood volume so you you'll store more blood in your body when you're more fit than you are less fit so I mean I could go on all all these things sodium concentrations potassium

00:27:54 concentrations are like you look at these things on paper and you don't know if that person's about to die cuz they're 65 years old and out of shape or if that person is going to break a world record the marathon this brings up a very important tangent which is uh for instance if you go and take a blood test and you are somebody who exercises very intensely uh with resistance training your blood creatinine levels can be way out of range and if your physician doesn't know that you're doing certain

00:28:20 forms of exercise might say wow there's a lot of muscle tissue damage occurring in your body um as you mentioned before your total blood volume is is dangerously High when in fact you are far healthier and indeed much fitter than the person who numbers would be in range that said obviously there are um limits to these to these statements whereby you would want to be cautious and take action to amarate a very elevated um blood creatinine level or something of that sort but the point you're you're uh bringing up is is also

00:28:51 one about the field of medicine which is that many not all but many Physicians don't take into consideration uh the outside activities that people are doing and so it becomes a kind of a plug- Inplay type um type way of looking at blood charts we've done many thousand athletes blood chemistry and uh we we don't use first of all we never look at disease stuff that's not what we do we take people that are healthy and try to optimize performance and blood chemistry is one of the best tools if you really

00:29:22 understand what you're doing there you can uh get some incredibly powerful information out of blood chemistry that actually relates to what we're going to talk to today uh in terms of measuring uh everything from acute to Chronic dehydration to sleep deprivation can be identified in in blood chemistry to optimization improvements in nutrition supplementation there's just a lot you can get there um even people interested in that field I would i' Point them to a gentleman named Dan Garner who's just an

00:29:48 absolute Juggernaut and wizard in blood chemistry for high performance but you can get a ton of information from that if you understand the difference between exactly what you talked about looking for signals of increased risk of cardiovascular events 25 years down the road versus is this the optimal value for high performance in an athlete which is what our our database and all of our software and stuff does is is only looking for those things so I'm going to talk about some of the biomarkers to

00:30:14 look for a little bit later um salivary stuff some blood stuff um but we'll maybe save that part of the conversation for down the road tell me about different time scales of recovery sure this is actually where I was trying to answer your question for and then I got myself way off track but the reason I brought up the hormetic thing is if you understand that some things in the acute say 24 to 48 hour period look terrible it's actually fine right so this is the stimuli that's causing adaptation so the reason I brought up

00:30:45 the medical U exchange there is because uh you if you looked at inflammatory markers and then you mentioned some of them you would see that they are highest acute within seconds to minutes to hours after exercise however that's exactly the stimuli needed to bring them down chronically okay and so chronically meaning maybe in that moment they are elevated and then maybe they're coming down 24 hours later and 48 Hours however if you were to compare your resting level say that Monday before you worked

00:31:15 out so your resting level that Monday the week following the week following that what you would probably see is your Baseline inflammation goes down and so we got to be really careful are we talking immediately post exercise man these markers look terrible maybe my recovery score is awful Etc that's not necessarily a bad thing because what we're like looking to do is to not only change what's happening today but we're trying to cause adaptation that may take us weeks or months to actually access I

00:31:46 love that you're highlighting this principle because one of the more obvious ones to me now that you've said this is heart rate absolutely my heart rate goes very very high during exercise and I do that fairly consistently or even semic consistently my resting heart rate will actually be quite a bit lower that's a fantastic example really what you're getting at here is this concept where I think it's important to differentiate between adaptation and optimization now we hear that word and I use it and most scientists hate it but

00:32:16 it's a good communication tool of optimization if you're optimizing for the current moment you're almost surely compromising delayed adaptation right if if I were to say do the thing

right now that makes you feel the absolute best in the world and you're like great you took a nap and you ate a dut like awesome you feel amazing but you know it's causing long-term issues the same can be said on the back end if you're never choosing things that make you better right now you're never actually going to see any

00:32:47 adaptation so what we're really doing with this recovery conversation is playing this game of balancing immediate gratification with delayed gratification and how do we identify how much to do now versus not how do I use a value or a marker whether this is how tired I feel today how sore I am today versus a score on an app or a tracking metric whether this is a blood marker anything and understand if that's what I need to cause the adaptation I want a week a month three months from now and in the

00:33:18 case of some of our other athletes it's even up to four years right we're trying to cause adaptations that will get us where we want to get in the Olympics or World Championships or World Cup or wherever we're going to be so that's the framework we have to think about recovery we we maybe falsely think about it is I need to maximize my recovery today and you could do something like take an anti-inflammatory whether this is a supplementation or a drug or maybe this is ice oh cool that's great that will

00:33:47 enhance your recovery in this moment that'll make you feel better today probably tomorrow but what we know is that blocks the signal for adaptation so you're not going to get the same results you know four six eight weeks from now so when we talk about recovery we have to understand what tool am I using and why and in order to do that we have to understand what am I training for and what am I trying to maximize um if I am in the middle of a season with an athlete and we are competing tomorrow I

00:34:13 am going to headed towards acute recovery right because I have to actuate that performance right now if I am starting the off season I'm not hedging towards recovery I'm actually hedging towards adaptation so we're not going to deploy any of these especially things like uh there's evidence that a combination of vitamin C and vitamin E will blunt hypertrophic adaptations because they're anti-inflammatory they antioxidants right um other other Studies have shown maybe they don't have uh inhibitory effect they may or may not

00:34:46 point is conceptually you want to be careful of what you're trying to optimize for and you have to have that forethought and that alone is going to dictate your decision making with whether or not again you get in the eyes uh you do everything now we will cover some tools like massage that are pretty fine to use you don't have to worry about those blocking long-term adaptation but others you're going to want to be very careful about so this principle that you've laid out for us which is that there's a set

00:35:16 of events that occur during exercise that trigger the adaptation and that sets in motion a number of adaptations that occur during recovery that then get us the exact opposite response to what the trigger was so I'll go back to the heart rate example um heart rate is close to maximal or maximal you do that enough times within a short you know a week or so or two weeks and your resting heart rate goes down as I recall a few episodes ago you said that your maximum heart rate doesn't really change that

00:35:48 much is that correct yes okay but your resting heart rate can go down quite a bit yep is that a general theme mean meaning do we have a more or less set upper limit or ceiling for things like inflammatory markers for heart rate maybe even things like stress and what we do when we deliberately trigger stress or a dramatic increase in heart rate or dramatic increase in inflammatory markers is that we are lowering the floor but that the ceiling Remains the Same it's very dependent upon the marker so in the case of maximum heart rate it

00:36:27 will not change with the exception of one thing which is age age brings it down training will not change it up in most circumstances if you look at something like an inflammatory response I suppose theoretically there is a ceiling though I'm not aware of it um I can tell you right now looking at blood markers of things like creatin kise so remember the conversation about metabolism and that we use phosphocreatine as one of our primary fuel sources for explosive exercise well if we're using phosphocreatine

00:36:58 U this creatin kinas now remember kinas are enzymes that that function to break things down for the most part so creatin kinas is the enzyme you Ed to break down creatine when you do that a lot then that creatin kise gets out of muscle and seeps into the blood um myoglobin is actually another fantastic marker by the way myoglobin is if you think about hemoglobin being in blood is the molecule that carries oxgen around when it's in the muscle tissue then it's my globin my meaning muscle and it's the

00:37:26 same globulin thing so there's a bunch of markers you can look at muscle breakdown and one of the things that you can see is a creatin k level that's elevated after say um one bot of exercise and and you might it might be up you know five or six fold um I've actually seen this number in offensive lineman in the NFL be something like 500 plus fold so even within just one category to the next that that number can get extraordinarily high and if you know this is actually one is important Point here if if you're paying attention

00:37:58 to any mechanistic research or use you're using that to inform your decision-making you have to be extraordinarily careful of magnitude and what I mean by that is if if I were to be

running a western blot looking at a signaling protein um in a muscle does did this activation of this protein turn on mitochondrial biogenesis and I saw that whatever intervention we gave it whether it was an nutrition thing or a drug or an exercise and I saw that that signaling protein increased by 20% I would basically assume that to be

00:38:30 totally physiologically irrelevant because in order for that to be important it totally depends on the marker you're looking at but you some markers I might need to see four five six hundredfold increase before I know that that will actually be enough to be what we call physiologically relevant others if they're up one or two% that is relevant and so you really want to be careful when you're either reading papers or looking at Social Media stuff if people are just talking about this marker increase this much it may not

00:38:57 matter it may be totally irrelevant physiologically and so you have to that that's also if you're wondering like how the hell are the all these people well that's how they can trick you a little bit and intentionally or not it could be just they're trying to their best but they don't really understand that area enough and so um that's an important point to pay attention to so to answer your question again fully it would be hard to determine if there is truly a maximum level um some things don't want to move like blood pH

00:39:26 it doesn't really want to move the range that you're going to move from is you know like 6.8 to 7.4 and if you get up to like 7.9 like you're probably in big big big trouble other things again can go up 500 5,000 fold and so the markers will really determine that answer well at some point in the future I'd love to continue this discussion around the topic of stress specifically yeah um and maybe we will get into that a little bit later today when we um get into the use of deliberate cold exposure

00:39:56 because that certainly um has effects related directly to temperature on tissue but it certainly has mental effects in terms of raising one's level of perceived pain it's fun also good or some people love it and some people love it for the feeling they get during it um deliberate cold exposure some people only like it for the feeling that they get after it not unlike exercise totally I I love to train I love exercise but I know many people who uh um they Lo exercise but they love the feeling afterward so this will be a theme that

00:40:28 we will come back to thank you for indulging my interest in that semi- tangent I think it's a relevant tangent if there is such a thing if you can now return us to the different time scales yeah and modes of recovery because I think where we are headed is how to get better at recovering yep let's talk about the tools let's talk about what to measure and identify for all four of these distinct levels so level one is what we call overload and just very quickly what that means is I did a workout today the sign and symptom of overload

00:41:03 is you're fatigued per acute performance is down so I worked out hard right now if I were to go try to do a maximum effort I would be reduced in my ability the recovery period for acute overload is minutes to days right that's generally what we call acute overload and that's what we're looking for right so we system should theoretically see that hormetic stressor come back in response come back bigger better more efficient Etc if you were to continue training in that state like most of us do and say I did a workout today I had a

00:41:34 little bit of a Cute Overload going to work out again tomorrow a little more acute overload going to work out the next day a little more acute overload even if you took a day in between it's that doesn't matter right you just continue these acute bouts of insult then you're going to be pushing into the absolute golden Target which is what we call functional overreaching so you have overreached what you can currently do and and it results in a functional outcome and what we mean functionally here is performance is enhanced and

00:42:03 again performance being whatever you deem it to be you're stronger know you've enhanced muscle size your mitochondria has improved you've whatever the thing is it's not just a physical performance thing right amazing recovery time for functional overreaching is typically a few days to maybe even a week or so and so typically what we see happen is prior to a competition individuals will do what we call a taper which is a reduced training volume for some short period of time and the the reason they do that is to again

00:42:35 actualize is the phrase we use here the adaptations and so you worked hard for six weeks and you know theoretically the workout you did three four five six weeks ago once you allow the system to recover will be actualized which means your performance will be enhanced here so functional overreaching is the golden Target okay if you were to be at the point of functional overreaching and you continue to train so it intensified whether this is through intensity this is through volume or really as you said

00:43:06 earlier you had something holding back your recovery it doesn't really matter right it's it's sort of two sides of the same coin then you would move into what we call nonfunctional overreaching so you've overreached again but now it is nonfunctional as in you did not see a positive benefit once recovery allowed this typically means you have weeks it takes weeks to come back from and you basically just get back to Baseline and this is where a lot of folks are who end up in this vicious cycle and so you're

00:43:37 like man I'm not getting the results I want I'm going to train harder I'm not getting results I want I'm going to train harder and harder but because you've recovery isn't improved you

just end up in the same spot so then you train more and you end up in the same spot and you end up then just either blowing up or quitting and you're not getting where you want if you were to continue past that point you may actually be into what we actually call overtraining and that typically is uh considered to be overtrained if it takes

00:44:05 months to recover from so most people think they're overtrained are really not you're just probably non-functionally overreached and again the classic distinction is if you took three or four days off and you felt better you weren't probably quote unquote overtrained you were probably just in this area of non-functional reaching you need a little bit of a back off if you and this has been the case I've had the app with gymnasts uh and a cheerleader and some other things where they take a month off and we're barely

00:44:34 seeing them start to come back to their Baseline numbers in any number of areas mood desire to train testosterone cortisol ratios bow markers in a number of areas physical performance vertical jump height like all these things they just start to get back to Baseline so over true overt training is actually quite rare nonfunctional overreaching is much more common and uh it is a a shorter time frame scale so when we talk about recovery those are the four pieces that we're really thinking about and so

00:45:04 if you are concerned about oh I'm super sore how do I get less sore how do I either not be a sore next time I do that same workout or I'm super sore now how do I recover those are playing in that first category of overload and we can certainly talk about how to figure that out but the quick answer is you got to go back to our previous episodes and just pay attention to the volume intensity recommend commendations if you're getting significantly uh more damage or fatigue in a workout you probably have increased

00:45:35 your volume too too quickly or something else is dragging your stress bucket down but generally this is a problem of training um you either didn't warm up sufficiently your fueling strategy is off which we'll talk about in The Next Episode or You' violated one of our principles of increasing intensity and volume sort of too quickly um if it's past that and you're getting to a stage where you're just like I'm feeling beat up all the time my energy is going down I'm just not feeling like I'm recovered now

00:46:05 we're in this overreaching stage so the the story I kind of tell here always is uh a few years ago I was working and uh my wife Natasha was in the garage training and I'm doing something and like she comes stumbling and she has this look on her eyes and they're like giant her eyeballs are giant she's just like wobbling she's like I effed up and I was like what do you mean you like effed up and she's just like I read the program wrong and she's like like what' you do like she was supposed to be doing

00:46:35 10 sets of three every minute on the minute and she did three sets of 10 every minute on the minute and she was absolutely wrecked she couldn't move for a few hours afterwards and then for days she's just like you have to handle the kids like I can't get out of bed I can't move so that was like a classic example of all right like we don't need to fix recovery here you're just a dummy and you did the training way too hard too long like this is not we don't have a problem here so if it's a situation like that it's generally you

00:47:04 just the program was way off if it's constantly happening where you're just like man like for whatever reason every once in a while I'm getting really sore or having a really bad performance in these workouts then we need to go to our other stress bucket take a look at our alistic load or allostasis and get figured out what's happening there um so those are the the easy ways to flag acute overload problems I'd like to take a brief break and acknowledge our sponsor athletic greens athletic greens is a vitamin mineral

00:47:33 probiotic and adaptogen drink designed to help you meet all of your foundational nutritional needs I've been taking athletic greens daily since 2012 so I'm delighted that they're a sponsor of this podcast the reason I started taking athletic greens and the reason I still take athletic greens once or twice a day is that it helps me meet all of my foundational nutritional needs that is it covers my vitamins my minerals and the probiotics are especially important to me athletic greens also contains

00:47:59 adaptogens which are critical for recovering from stress from exercise from work or just general life if you'd like to try athletic greens you can go to athleticgreens.com huberman to claim a special offer they'll give you five free travel packs and they'll give you a year supply of vitamin D3 K2 again if you'd like to try athletic greens go to athleticgreens.com huberman to claim the special offer I'm happy that you pointed out the distinction between functional overreaching overtraining and

00:48:25 being overtrained I think one common mistake that people make in thinking about biology generally is that they think in terms of nouns and adjectives and not verbs amazing I love that so much you know biology is a collection of processes or processes depending on who you are and where you live and who you trained with being overtrained is a state that in many ways is an adjective you're overtrained I'm overtrained it's like saying uh you know I'm an American I'm a you know Czechoslovakian whatever it happens

00:49:02 to be right and in many ways people do start to associate with an identity at least a transient identity and they start making all sorts of decisions it sounds like about what sorts of

verbs they will and will not engage in whereas I think if we look at things as processes and we assign verbs to them then we can say okay I'm functionally overreaching or I'm truly over training which is a matter of degrees correct right or under training for that matter I'm not I'm reaching but I'm not functionally reaching it's just it's

00:49:36 just performance and you know just as with the nervous system won't change unless you give it a reason to this is the reason why if you can perform something perfectly or speak a language perfectly there's there's no rewiring of the nervous system this myth that we've all been told that every experience rewrites your nervous system it's different now than it was two seconds ago that's that's a ridiculous illogical statement we know that's not true if your nervous system can perform something it has no reason to change and

00:49:59 it won't muscles the same way this is why you have to progressively overload you have to learn something new or challenge your muscle to do something new it's same thing so in the example that you gave uh with your wife doing this workout that turned out to be far more strenuous she had functionally overreached in some sense she might have been overtraining or heading in the direction of overtraining but the mistake would be to assume that she was overtrained right as a kind of it's almost becomes a bit of a state or a

00:50:26 character assignment um as opposed to a verb and in any case there's no perfect way to describe this we're talking about nouns and adjectives and and we're also um uh talking about verbs but I think the verbs are really anchored down in processes and things that we do actions that we can take and so um if I may I'd like to just highlight this this idea of Shifting one's thinking towards verb actions rather than labels on the state that we happen to be in or the person that we happen to be right sometimes it

00:50:58 even does become kind of characterological in the way that people describe it and uh so I have to believe that there is something called overtraining that overtraining is real in other words but that we don't ever really know if we're overtrained you nailed it there's no you know it's not like a red flag you know shoots up out of your shoulder it's like I'm overtrained you know it's um so in doing so I hope that we can start thinking about some of the verbs the actions that we can take in

00:51:28 order to ensure that we stimulate Progressive overload one way or another and at the same time that we don't fall into these bins of character assignment where suddenly we decide that we need to do X like take a month off or something like that because I I'm beginning to realize um from our discussion that that's exactly the wrong way to go those are fantastic points I I want to make sure it is clear that there is no clinical diagnosis for overtraining there are no standards there's no test or or a blood panel you can pull that

00:51:59 would actually identify you in that state so your your distinction Here Andrew of these are verbs rather than nouns is is so wonderful because that is exactly the case uh the only way we could really come retroactively diagnose one with overtraining is if again we had you did weeks of recovery and you only got back to Baseline so we can't do it in the moment I can't take a single test um there's no subjective marker or anything that says you are overtrained it is simply you are probably overtraining and we need to reverse that

00:52:31 quickly or in the case of the step before you are probably fun non-functionally overreaching and if you continue to do this you will probably enter into a stage uh where this is your overtraining and we need to come back so that's an important thing to let people know is there's no one thing we can actually point to that says you are here you are not a noun this is a verb so what are some tools that we can use to enhance our recovery yep let's start off with that a Cute Overload phase so in other words I just did a workout and I'm

00:53:01 feeling awful or I just did one two days ago and I'm super sore how do I get rid of that right now well there's a couple of things you can do immediately after your workout and then others that are maybe more actionable a day later or two days later and we'll just cover handful of them we'll do some nutrition and hydration and supplementation in the next episode I'm going to cover everything else not in that category right now so a couple of things number one uh you actually start Kickstart that

00:53:29 recovery process at the end of your current training session and I guess I should say it this way I strongly suggest you start this recovery process immediately after the workout you mentioned earlier about this idea of you got to get a really high peak of stress to cause adaptation but I actually didn't explain that correctly because what has to happen is you need that extremely high peak but then you have to be met with an extremely sharp recovery back down and so you know you've talked about this before in some of your

00:54:01 neuroplasticity stuff and in terms of what has to happen that caus the insult and then you immediately need to be able to recover to make sure that that causes changes in the brain same thing happens here so we need a really sharp and high inflammatory response and then if you do not meet it with an immediate recovery period the signal won't be there to maximize your results so what's that mean you can actually do a couple of things number one is listening to slow paced music there's evidence that

00:54:30 suggest fast-paced music May uh slow down your recovery and slow pace would actually enhance it so if you just change from you know your maximum get you up and get going

music during the workout to a slower lower Cadence that will help you Kickstart the idea of a similar note you can also use what we call down regulation breathing you could do them in conjunction or one or the other whichever is up to you so my personal favorite method here is is somewhere between 3 to 10 minutes of finishing your training session laying

00:55:02 down i' like to be in that position you could certainly do it in the Lotus position but I think laying on your back is generally more effective personal preference there no signs uh I like the eyes being covered getting into this dark quiet sort of area and then just breathing through your nose in a structured Cadence there's a lot of different things you can try an easy example is just box breathing so and you can imagine box having four squares so what you're going to do is inhale for somewhere between like 3 to 8 seconds

00:55:30 and then whatever number you choose you keep that same tempo and so let's say you chose to do a 5-second inhale that's going to take you up vertically and then horizontally for your box is a 5-second hold and then a 5-second exhale and then a 5-sec hold and you just need to repeat that for the time domain I typically honestly don't use a timer you'll actually notice a lot of people will like fall asleep or get really close to falling asleep in this period you could do a triangle version of that where you do an inhale hold

00:56:01 exhale and then go right back into your inhale or there's a bunch of different tricks you can try here you need to play around and see what actually works best for you 10 minutes is probably better but if you can just at least give me three that'll work if you're really really resistant you can actually do that just in the shower and so if you're going to finish your workout get in the shower again just close your eyes in the shower give me three minutes of focused relaxation breathing and that will

00:56:26 accelerate the recovery process I love it and I particularly love it because my laboratory works on stress and respiration AK breathing and the interactions between the two and I'll just mention a result that was just accepted for publication so should be out by time this episode SS uh thank you uh this is the beautiful work of uh not me directly although it took place in my lab but as we know it's the students of posto really do the heavy lifting of um Dr maliss U balbon uh in my lab it's a phenomenal

00:56:57 researcher that showed that a short period of 5 minutes of box breathing of exactly the type that you described or uh cyclic sign so two inhales followed by an extended exhale to lungs empty ideally the inhales are done through the nose the exhales are done uh through the mouth although it could all be done through the nose um or the mouth for that matter but probably nose nose for inhale inhale mouth for exhale or um uh in inhales through the nose and and xhl through the nose cyclic sing as we refer

00:57:29 to it done for 5 minutes both of those produce very significant uh decreases in resting heart rate the over time will increase things like heart rate variability and so on and so forth um so provided that there are extended exhales it seems like the calming response and the reduction in overall stress occurs the only thing that really sends things in the other direction would be something like cyclic hyperventilation I'm sure you've observed that um and interestingly uh when we had people just do 5 minutes of

00:58:02 u meditation which during which of course they are breathing but they're just allowing their breathing to progress however it happens to be in that moment um or moments across the five minutes uh there were reductions in the same sorts of markers of stress that I described but not as significant as breathing so I love the Box breathing tool post-workout um and there's some other Alternatives there too that I just mentioned but I think people greatly underestimate the potency of breathing for shifting one's nervous system

00:58:33 function away from stress or if one wants toward more alertness and stress I actually have a couple questions for you on that sure I think the audience would appreciate this um how long were those boxes was it just user selected great question so we use the carbon dioxide tolerance test amazing in order for people to determine how long the different sides of the Box should be and you cover carbon dioxide tolerance test in previous episode and we can provide a link to that clip um in the show note

00:59:00 captions but as you point out it involves a long extended exhale to lungs empty um and of course people could sit with lungs empty but uh they have to accurately Faithfully as we say report how long it took them to empty their lungs we use that as a as a gauge typically if it takes if people go to lungs empty in 20 seconds or less I believe I have to go back to the paper and look but I believe that the um duration for each of the sides of the box boxes as it were was somewhere between um two and 3 seconds if they had

00:59:32 a uh CO₂ discard time of anywhere from uh 20 seconds up to about 40 45 seconds we used a the sides of the Box were I believe um between four and six seconds and then for people longer than a who could discard their erir over a period of a minute um or more we used a uh box duration that is inhale hold exhale hold duration of somewhere between I believe it was um seven or maybe it was eight and um as long as 11 or 12 seconds you get your kind of free diver types who can really do this um who are really

01:00:06 well trained for this sort of thing the don't quote me exactly on those numbers but that that was approximate those line up exactly with what what we've done so I I believe it's it's

going to be close within seconds of non-important Distinction is it's going to be close you know so that's great and that was uh it took them what six weeks before they uh so this study was done over the period of a month and then when they were swapped into a new pattern of breathing um condition or meditation condition and this was all done in in

01:00:35 the natural world as we say um they were wearing woot bands that we were getting heart rate heart rate variability sleep data subjective data about mood Etc so there were a lot of measures but this was um more than 100 subjects out in the wild of life um and we tried as best we could to track life stress events and exercise and things like that that was harder to control outside the laboratory really all those results speak to exactly what you're describing here which is that deliberate respiration

01:01:02 that involves controlled holds and exhales really has a dramatic and very immediate impact on reducing our levels of stress that that's wonderful I'm not surprised at all uh with your findings and what's really interesting about that is you mentioned how the exhalation portion is primarily responsible for the down regulation and that's actually goes back to our previous endurance conversation which is that in general at rest at non- altitude increases in CO2 are the primary driver for ventilation

01:01:36 and so what that generally means is inhales are associated with an uptick and sympathetic State and exhales are associated with a uptick of parasympathetic State uh this is generally why folks will do things like exhale and finish that exhale right before they perform a very high Precision neurological task so if you're going to say aim at a Target and shoot you're going to Exhale fully and then almost always execute that movement at the end of the exhale because that's when you're in your highest

01:02:08 parasympathetic State and lowest drive for ventilation I have to say I'm not surprised at all that you guys found that there's actually other data that point to individuals particularly after endurance training that can get backed down to Baseline heart rate is going to be correlated with who gets the most actual results of the training said that if you take a bunch of individuals and put them through an endurance training program and if you measure how quickly they can get back down to Baseline after each workout in

01:02:38 general those folks that are better at that are going to see greater improvements in performance at the end of your say four six or eight week training block and so there's a little bit of causation and correlation there that we have to untie but I think it's enough to say hey if you invest these three and in your case your your study was 5 minutes it's only going to enhance recovery you have a likelihood of increasing the results from your training and now we also have additional benefits like being able to transition

01:03:11 more appropriately into our next task going to work going to see family whatever the thing is and it's it's a nice close to I asked you to be in a high sympathetic State body and I asked you to perform and to be under stress I gave you recovery and now we're ready to transition in our next thing so that we don't take that exercise energy if you will into our next task which may or may not want me in a sympathetic Drive state so if somebody is sore following a workout either locally sore in a muscle

01:03:43 group or group of muscles maybe in their legs or chest or torso or maybe their whole body is sore as it sometimes is the case what are some tools that they can Implement in order to to accelerate the I want to call it moving out of that soreness but it's really uh as we know the alleviation of the soreness through a bunch of different processes what are the most effective tools to push back on that soreness and dissipate it yeah absolutely first of all it's not lactate that's is a really important thing that

01:04:15 we still hear people talk about is you know you're sore 24 hours later you got to do this thing to get the lactate out of there as we talked about in the metabolism uh conversation and episode that that is not the cause of fatigue and it's certainly not the cause of soreness so not an actionable tip there but just a pet peeve of mine when I hear people say that that I get irritated so we can maybe in that conversation um strategies tools here's what you can do you can actually wear compression gear

01:04:43 that will help a little bit there's a decent amount of evidence suggesting if you just were to you know put some tighter fitting clothes on Leisure wear or compression gear if you have it that that can actually prevent a little bit of soreness from occurring so if you're in the case of poor Natasha and you realize you just done way way way too much or you went and hung out with your bow hunting friend and you trained way too hard and you realize oh my goodness I'm going to be very sore here you can

01:05:07 immediately put on compression gear and wear that really for as long as possible what are some examples of compression gear I've seen people on the plane with those high high socks um I mean anything that you wear compression gear for what you do for exercise so whether these are just uh you know compression pants and leggings the tight fitting leggings uh whether this is a long sleeve shirt that's like a rashguard you would wear in you know Jiu-Jitsu or surfing or something like that as long as it's

01:05:34 tight fitting it doesn't have to be much more than that you can wear I suppose you could get the socks would be great but um we generally just tell our athletes um they would put on

long sleeve compression shirts that they would wear for their training and then long compression leggings and that'd be fine can people apply these compression um Garb after training and still get some of the positive effects yeah I have not seen any evidence to suggest that that would block adaptation that may be the case I I am not aware of those

01:06:03 studies if that happens but um I certainly know that the information suggests it can't hands a little bit of Muscle Recovery but ideally one knows if they are about to do a workout that could trigger a lot of soreness and then wears compression gear of some sort to offset that and if so does it have to be local to the muscle groups that you're working on the reason I asked about the sock is my understanding the socks that the compression socks people wear on the plane is that it's going to shift the

01:06:30 patterns of blood flow not just in the lower legs but all over the body yeah you're probably going to want to focus it on the actual exercising tissue though actually that's a really good question I don't know the answer of whether or not you did an upper body workout only or lower body compression gear if that would actually help that's a great question that may have been done I don't know but I don't know the answer to that in general we just tell people like we wear the whole thing as much as

01:06:52 you can um I actually am not concerned that you're wearing it during your workout it is something you could put on afterwards or even wear just a little bit of compression the other day um we've actually did a really fun study uh I collaborated with um Bill Kramer who's uh you know Sports scientist of the Year award is the bill Kramer award if that gives you an indication out of uh University of Connecticut as well as with Lee Brown so two Lifetime Achievement Award winners and we we put people on a a plane in stores

01:07:23 Connecticut and flew them to Cal State Fullerton so a cross Country flight and some of them got to wear compression gear during the flight and others did not and then they landed in California did a training bout put them back on the plane went back to stores and I think they did another training about when they got back there there was a lot of data that came out of that paper but one of the things that was clear is the compression group was effective um at handling some of the blood related coagulation and other issues associated

01:07:50 with uh long flights and particularly athletic performance so that's actually a sneaky little Insider trick that I'll use a lot with people particularly with athletes that are traveling is just wear that compression gear on the plane so you you talked about that and that sort of rung that study to mind that it's another effective strategy so compression gear in general as well as particularly on a plane um basically the tighter you can get it the better without obviously making your hands purple and being uncomfortable and

01:08:16 things like that so it doesn't have to be overly tight uh anything will work and probably help so I'm also doing that personally anytime I'm taking a flight like that as much as I can just feel a little better when I get there so what are some other methods that we can use to alleviate acute soreness well if we continue down this same theme which is saying okay we use some sort of pressure manipulation to enhance recovery if compression is one strategy you can also use things like um compression boots or

01:08:47 garments and these are pneumatic devices that will you know pump uh air outside you and compress back and forth there's any number of devices that will do this um you can also use the physical hand so this would be massage and body work um they're all really working as best we can tell on the same mechanisms uh which are effectively moving fluid in and out of the tissue as well as potentially enhancing blood flow uh increasing capillarization and which is going to only get nutrients in and waste products

01:09:16 out so you can kind of pick and choose based upon your budget uh preferences availability timing things like that so those are all effective strategy outside of that really is the next largest category which is now thermal and uh and so far in this discussion we've mentioned cold water immersion and I talked about in the hypert section how you would not want to do that immediately post exercise which would be getting into cold water or an ice bath if you're trying to grow muscle mass having said that there is good evidence

01:09:49 showing that cold water immersion specifically is effective at reducing muscle soreness so so it is a fair consideration and it's a classic example of how there are no free passes in physiology nothing is always good or always bad it's always about what are you willing to give up and versus what you're willing to get and in the case of like cold water immersion you may be thinking yeah I might blunt some of the hypertrophic adaptations but if you're in that phase of training where you're actually trying to push more towards

01:10:19 optimization in that moment rather than long-term adaptation then a an ice maath might be a great choice in addition if you fall into a scenario like Natasha did and you realize like I'm just so unbelievably sore this might cost me three or four or five or six days of training it might be worth it for you to accelerate that recovery process by a couple of days so that you don't miss so much training so it's it's just a it's an algorithm it's an equation what am I looking for again if I'm in season or

01:10:46 trying to compete or if I have just done way way way too much exercise and I'm really in significant pain you would probably be willing to give up some small percentage of eventual

muscle growth after a single session to get out of pain so um of the cold strategies cold water immersion is clearly the best approach rather than cold air or some other tactics so a cold shower is probably not enough here you really do uh want to be either in moderately cold this is maybe 40 to 50 degree water uh for probably north of 15 minutes or you

01:11:17 can be in sub40 for as little as maybe 5 minutes to get some of the effect and there's been a number of studies um so I'm sort of summarizing a bunch of that kind of into one rather than going through them Point by point the numbers you just threw out U which I'm assuming are um uh Fahrenheit um seem seem really cold to me right uncomfortably cold absolutely so I always recommend that people ease into it as a protocol overall that they not immediately go to 35 degree uh cold water if they've never

01:11:48 done it before uh that said once people are comfortable being uncomfortable because I always answer the question how cold should it be exactly would you agree that it should be very very cold so much so that you really really want to get out but that you're able to stay in safely whatever that value happens to be you absolutely need to be safe having said that we have actually in our xpt Retreats put dozens if not hundreds of people at this point uh immediately into the sub35 degree water their first time

01:12:19 ever and done you know 3 minutes multiple rounds uh in a session so they can handle it but you don't need to go that crazy if you don't want you kind of have to play a game right do you want to be really really cold for a short amount of time or do you want to be like kind of cold for a longer amount of time I really the only mistake you can make is doing something like you know 65 degree water which for most people is not very comfortable and doing you know five or 10 minutes it's just not going to be

01:12:46 effective it's probably not going to be effective so if you're like man 35 is is absolutely crazy and you want to do 55 degree water and there's literature in that area but it's going to say you need to probably be there you know somewhere almost surely north of 10 minutes and some of it will actually show you need to be in there like well north of 20 to 30 minutes so for my money I would rather go really really cold and get it down in five minutes but um personal preference on this one you can also make

01:13:10 it a little bit easier on yourself there is not nearly as much evidence but there is some on contrast stuff so uh this is when you go cold hot and sort of back and forth there are no really good rules in terms of how much should you go how many rounds how long and cold how long and hot again there have been a couple of studies but and obviously those studies use numbers but that doesn't mean those have been tested to see what what are optimal which is a very big difference so um you can really just

01:13:40 kind of play that by feel hot is good for Recovery you just have to be careful because you are going to put more blood flow in the area and so you may walk out of there with some additional acute swelling which is then going to put greater pressure on there so you have to kind of play with that I personally really like hot uh for Recovery I will feel maybe not great in that moment but the next day I tend to feel really really good in addition if I wake up the next morning and I'm really really hurting and and I'm super stiff a

01:14:10 hot bath will help that um quite a bit so you can play with some of those protocols again you don't have to do ice there's absolutely no requirement to do so it is just an option if you're interested yeah the studies of Dr Susanna soberg um sure yeah are not directly aimed at alleviating soreness or recovery they're more about increasing thermal capacity by a storage of uh Brown adipose tissue not the blubbery fat but the stuff around the clavicles and around the heart that help you generate body heat at rest and

01:14:43 metabolism and so on and the numbers there that um she's come up with again have not been tested against all the possible derivations just like with breathing we did five minute sessions but who knows maybe a minute would have been equally effective we just there are constraints on these sorts of studies but the values that she's come up with which seem to be good thresholds for making sure that an adaptation response is triggered by heat and cold is it ends up being 57 minutes per week total of

01:15:10 uncomfortable but safe heat in that case sauna and that can be all in one session or breaking it up into a couple of sessions on the same day or or different days and then 11 minutes per week of cold either in one single session or multiple sessions again one could do more um one could break that up over you know multiple days or do it all in one day or do it all in one you know an hour in the sauna and then 11 minutes in the cold or vice versa although that seems a little bit extreme especially for the

01:15:36 uninitiated but those are the numbers that have been studied but as you point out there are not a lot of really thorough studies examining different cold protocols according to temperature by time requirements so there is a bit of subjective feel required to establish a routine and I would actually say this is another time to re-emphasize something we talked about at the beginning of our conversation which is that pain itself is not a defined outcome it's heavily influenced by your perception and so if you don't

01:16:04 feel like they work for you they won't work if you feel like they work fantastic they do so it's a challenging field to get really objective data on so there's always going to be a little bit of

subjective nature to some of these things I can tell you anecdotally we've used hot and cold contrasts for a long time with athletes um some love it some don't care for it and everything in between so it's one of those things where I never mandated of course I can't mandate anything for anyone I work with but I'm

01:16:35 never you know like hey are you interested great you're struggling in this area you want to try this you did and you liked it great you're struggling in this area and you tried it you didn't love it okay fine I'm not we we'll find other routes as we we'll get into there's a lot of ways to enhance recovery um this is only one and it hasn't even really come down to stopping the problem in the first place we're not we're just treating symptoms which is first line of defense but you really need to go back and figure out why it's

01:17:02 happening to begin with as a solution these are just different again acute symptom management tactics one final point about uh deliberate cold exposure I think worth mentioning is one of the reasons the shower is effective but not nearly as effective as cold water immersion or immersion in ice up to the neck is simply because of the reason you stated before which is that most showers are not going to get that cold you're not going to get down you know into the sub 40s um also cold showers haven't really been

01:17:33 studied that much they have but not nearly as much as immersion and people always ask why I just think about the challenges of studying cold water uh exposure in the shower where you can't really control for how much of the body is covered whether or not the head stays under different Siz bodies Etc whereas when people come into a laboratory they can get into a cold water tank we know where the neck is know where the chin is and we can make sure that people's arms and um legs are underneath but with cold

01:18:00 shower sure you can make everyone face away or toward the shower but it's really tricky and um for all the variations that that were described that said would you agree that if one wants to use deliberate cold exposure that cold shower is better than nothing and cold immersion in circulating cold water or ice bath is better than um than cold shower yeah what I would actually say if you're looking for recovery for muscle soreness I would say cold shower is probably doing very little U because you're not going to be able to get

01:18:30 enough cold water onto any muscle besides basically your head um so maybe you could try a cold bath uh and so you at least get some surface area coverage but yeah if you want to use cold shower for all the other awesome reasons cold shower that's totally great but if you're trying to use that to recover your low back and glutes from being sore from training in a good way it's probably not going to do much the the immersion would be there you actually also hit sneaky other point which is if you can't get your water super cold just

01:18:58 make the water move so if you have Jets and stuff you can turn on and anyone who's tried this and you're like okay I can do a 40 Dee bath awesome uh try 60 when the water's moving right because you break up the thermal layer normally you have a little thin layer of water that you're heating up you break that up it's a whole new world yeah absolutely so being very still in the cold water is actually the weaker way to go correct that you can make your face stoic but make your body circulate some water

01:19:23 around you as long as we're on this maybe just one more point about heat uh I've certainly used sauna wet sauna dry sauna steam sa saunas excuse me jacuzzi can work pretty well y um uh males if you are looking to conceive in the 60 days following uh following sauna or um hot tub do realize that it that both those approaches do severely limit the number of motile sperm um substantially so for people that are not trying to conceive don't think that this works reliably enough that you could use as a

01:19:58 form of contraception yeah but but for people that are trying to conceive it really is detrimental to to sperm Health right and so for that reason some people bring an ice pack and put it on the groin or near the groin uh when they go in but um which is harder to do in a hot tub than a sauna so here we're getting into the fine points um or crude points if you will pun intended but um but the idea is that we we wouldn't want anyone to approach these techniques and compromise their other life goals

01:20:26 was not allowed anywhere near these things when uh we were at that stage of life I I'll just say Natasha put an x on me hanging out with lared so going going in no for those reasons she's like you're not going in you're not going none of the stuff and I just had to wait right he um heat and sperm have a have a relationship but it's not one that's positive for the sperm I'd like to take a brief break to acknowledge our sponsor insid tracker insid tracker is a personalized nutrition platform that

01:20:51 analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate and long-term health and well-being can only be analyzed from a quality blood test one issue with a lot of blood tests and DNA tests out there however is that you get information back about various levels of lipids and hormones and metabolic factors Etc but

01:21:15 you don't know what to do with that information inside tracker makes knowing what to do with all that information exceedingly easy they have a personalized platform that lets you see

what your specific numbers are of course but then also what sorts of Behavioral dos and don'ts what sorts of nutritional changes what sorts of supplementation would allow you to bring those levels into the ranges that are optimal for you if you'd like to try insid tracker you can visit insid tracker.com huberman to get 20% off any of insid tracker's plans

01:21:43 again that's insid tracker.com huberman to get 20% off are there ways to combine uh the various types of um stimula that you described for inducing recovery you talked about breathing based tools um which while they could adjust and indeed do adjust oxygen and carbon dioxide ratios and Etc I'm guessing the major effect of those on recovery is going to be neural it's going to be deliberate calming of the nervous system more sympathetic based uh you mentioned yeah most definitely and then you talked

01:22:15 about some movement based and touchbased approaches um which will uh movement cly certainly will circulate blood but also will generate contractions of the muscles yep right which maybe if indeed again it's still speculation if indeed some of the soreness is due to excessive stretch or swelling at the stretch ends of the of the muscles that would make sense so movement and touch and then thermal are there ways to to combine these um that are more effective or maybe even synergistic yeah I suppose

01:22:44 you could throw on uh some compression garment put on a Pneumatic compression device and sit in the sauna while you down regulate your breath like that that would be fine quite honestly though you probably don't need to maximize all of them we were joking uh you could probably go for a light swim while regulating your breathing in cold water uh you get the compression from the cold water and and you'd be in a good spot so you can certainly do that the reality of it is I generally look for some physical

01:23:14 approach and then some uh holistic approach of the breath work basically so I want breath and then something else if you knock those two things out you're in a good spot so that could be breath while you're in thermal stress so just controlling and doing the UN regulation stuff you have to also remember ice is a stressor and I'll actually show you some data here in a second about how that actually can enhance um systemic recovery although it won't happen in the in the acute minutes in fact it's going to take at least 30

01:23:46 to 60 minutes and then you'll eventually see a rebound effect but acutely it's going to make you actually more sympathetic which is going the other direction heat can do the opposite opposite or it can actually drive you up so it's a little bit dependent upon how you respond what time of day um and how you're using so in general I guess uh combining them is if you need it um depending on what you have what's available so perhaps you don't have a sauna but you can take a hot bath great maybe you have some

01:24:15 percussion device some tool and you can use that but you don't have u a sauna amazing don't have ice bath these things so I think rather than thinking about an optimal combination of them I would say just use a couple of the tactics based on what you have and what is easily available um in your situation I'd love for you to teach us about some of the methods for longer form recovery as it relates to overreaching and overtraining sure you want to think about this in a couple of phases phase one is to try to

01:24:45 prevent it from happening in the first place uh in terms of training load you're going to just go back to our previous episodes where we talk give you specific instructions for how much to increase your volume and intensity per week Etc the other thing you can do then is do some monitoring and I'll I'll go over some different tools some cost-free ones as well as some some higher techologically demanding ones uh to monitor to see if it's actually happening and then the third approach here is what if this is already occurred

01:25:11 I figured out I'm so how do I get back out of that hole so I would like to just sort of tackle these one by one in order and and talk about what's happening what tools you can use and why they're going to work all right so anytime we're talking about fatigue management here most people are aware of these terms because if you have any sort of Technology uh you're probably getting some sort of Readiness score or recovery score or strain depending on which app or watch or Tech you have you have a little bit of

01:25:41 vacular change if you're in the sport performance world you might be looking at things again like load or GPS tracking and monitoring and really all of it is is doing the same thing it's trying to either one predict a problem is going to happen in the future and then placing restrictions upon you so that you don't run into that situation the other thing is possibly doing is identifying a drop in physiology or performance and then saying we need to get you out of this hole that's really what's happening and

01:26:13 so when we think of the first one just imagine uh a scenario like a mileage limitation uh pitch count in baseball and what has happened there is is you know individuals in those fields have looked and said hey what we notice is people who throw say more than a 100 pitches in a game tend to start losing Effectiveness and increased injury rate therefore we're predicting the next time you go to play if you cross that threshold we start having an increased risk of negative consequences so therefore we're going to cap your in

01:26:45 this case pitching volume at that 100 pitches per game or whatever the case same thing with running etc etc so you could just simply do that and there's actually really cool data

coming out now on sport performance stuff looking at things like Imus and GPS trackers and trying to identify even position by position specific uh recommendations for how much distance you should cover in a practice in a training session um so that you can say hey these positions don't cross this threshold these positions don't cross this threshold in

01:27:15 basketball and tennis and and all kinds of things like that that's not probably extremely applicable to many of the listeners right now but it is still conveying the idea that that if we understand where we break then we can stop ourselves from getting there in the first place the functional example uh here is just thinking about basic things like where do I start my training program and then how do I progress it and we've already covered those numbers in either case though you want to have three markers that you're paying

01:27:45 attention to if you're concerned you're getting into an overreaching phase or potentially going to lead to overtraining or you want to get out it's three unique things number one we're going to look for some sort of performance metric right so this could be um your times are going down your your squat numbers your power is going down any of these things so it's got to be an actual performance number two some sort of physiology and so I want to see something happening with resting heart rate some biomarker is

01:28:14 moving uh heart rate variability some other measure that is not influenced by you and the beauty of using biological markers are if we contrast that to like performance and I said okay here's our performance test every day you come in you're going to do a vertical jump and if one day you come in all a sudden your vertical jump is super low I might think oh man maybe we're starting to overreach you also could be feeling lazy that day and just not have jumped very high on purpose because you didn't want

01:28:44 to work out the beauty of biomarkers are you don't get to manipulate them like that they don't care there's a downside to it which is maybe they're just indirect markers right and so I'm not telling you biological markers are better than performance markers what I'm saying is you want to look at both all right in fact you want to look at our third category as well which is some sort of symptomology and so am I having a symptom of overreaching am I seeing a performance decrement and then am I seeing a

01:29:14 biological marker as well if you see all three of these popping up you have reason to believe you've reached some overreaching now what you have not identified yet is if that is functional overreaching non-functional overreaching or true overt training and remember you shouldn't be feeling great after every training session you're trying to cause adaptation and until you back off maybe even weeks or months later to actualize the adaptation and get that super compensation and performance increase

01:29:45 you're going to have to invest a little bit so you're going to go in the hole um any sport performance coach is going to look at numbers throughout the year and say yeah yeah when we first start training and preparation for this the season we are going to see a drop in performance that day that week that's part of the plan though right that's the stress you're trying to accumulate so you want to see all three of those markers you just want to pay attention to a couple of things how long are they

01:30:07 down for a day three days 7even Days 15 days Etc if you're seeing a performance drop in a day and I am far away from from performance uh so the day that I want to peek for I'm not going to do anything different if I see two days in a row drop performance I'm not worried if I see more than probably in my opinion five days in a row of decrement then I might start paying attention if you're in season though or close to competition or whatever that thing means to you and you see more than a couple of days in a row of dropping

01:30:44 then you might actually want to take some some steps to mitigate that so it really is important you understand again what are we trying to do are we trying to cause adaptation are we trying trying to cause adaptation and I I have a very specific example of all this we can run through uh here in a second and then of course a bunch of tools to to pull you out of those phases but that's that's fundamentally what we're trying to do here uh I would encourage you again don't be too reactive and responsive to

01:31:12 any one measure I'm going to cover a whole bunch of them in a second but you can get lost in in different things because they all have pros and cons and so I know it's simple to just look at one score on your watch and make your decisions because of that or check your app but you really want to be careful of doing that you're going to probably lead yourself in the wrong direction more often than you're going to help yourself I'm curious as to why when we overreach too much or too often or we are

01:31:40 overtraining that performance is diminished because on the face of it it's kind of obvious you're overreaching you're overtraining so performance has diminished but that's completely circular you hear about things like adrenal fatigue and adrenal burnout well it turns out adrenal burnout doesn't even really exist absolutely not there is such a thing as adrenal insufficiency syndrome but course you know these phrases like burnout adrenal burnout overtraining um they're thrown around you know as much as words like

01:32:10 gaslighting and obsessive compulsive you know are without any real clinical definition um or there are clinical definitions but people aren't obeying them when they use the

language I do want to acknowledge however what is absolutely true which is that over reaching too much too often overtraining these can degrade performance but mechanistically speaking what's going on because I think if once we understand what's going on mechanistically then I think um we can all look at tools whether or not it's

01:32:40 breathing movement compression thermal psychological um motivational Etc and have a much clearer sense as to what's going to work best and what likely won't work I love this question so much because as I mentioned at the beginning I I was fortunate to spend my uh some of my graduate work in Andy fries Lab at the University of Memphis and we we did a lot in this area and so we in fact this is how I learned how to do assays and run Western blots and measure signaling proteins and things like this

01:33:13 so this stuff is near and dear to my heart we also did a bunch of really wild studies and he had done some before I got there so I'm going to combine kind of Andy his entire career uh and just highlight some of the big pictures of what he found there um he was very interested in exercise particularly strength training and trying to figure out this entire question right which is like why is this actually happening when I work out too much when I lift too much that all of a sudden I can't sleep what's happening like why is my energy

01:33:44 down why is my mood my motivation reduced if I squat too much so we did a whole series of studies across his career and again I'll just sort of highlight some of the the some of the themes that ran through them so the first one that jumps out to mind is early in his career he did this really awesome protocol um where he had people squat 100% of their back squat Max every day for two weeks so you come into the gym and and I think this first one was on a machine and you did a one rep max and then you came back in every

01:34:13 single day for two weeks so these are what we would generally call kind of like that short to moderate range overreaching and by definition some of them ended up actually being true over training because it would take the individuals sometimes two to up to eight weeks to return back to their one rep max at the end of these protocols um so some of them were non-functional overreaching or some combination of that well along with that he took uh a lot of blood samples as well as muscle biopsies to try to look at what's happening

01:34:44 endocrinologically um neurologically muscle physiology wise to pay attention What's happen so a couple of things that jump out there um one of his initial studies actually I think the very first one he did did um when they ran that first uh squat everyday protocol what they found was camine levels changed quite significantly um and depending on kind of what you wanted to pay attention to there whether it was epinephrine or nor epinephrine um or even uh some other markers they basically increased by somewhere between

01:35:14 two to three fold and so a little bit of understanding of sleep physiology if adrenaline is extremely high epinephrine you're going to have a hard time sleeping so that alone was was first indication this is like wait a minute something's actually happening here that's just beyond muscle soreness there's some sort of systemic fatigue happening and as you rightfully pointed out is not the adrenal glands becoming fatigued that's sort of a bit of tongue and cheek and pedantics it is cortisol disregulation and general stress

01:35:42 syndrome um but it's really can be noted in in blood in terms of epinephrine and norepinephrine another study he had done of a similar realm was over the the course of seven and a half days people came in and did 15 training sessions so it was really cool these are these really short BS of just ridiculous training and they said okay like something's happening with with epinephrine and norepinephrine something HP something's happening with testosterone what's it look like inside the cell so now muscle biopsies came on

01:36:12 board and they started looking at things like map kinases which are these signaling proteins that are tend to be associated with an anabolic response they upregulate muscle protein synthesis and they do many other things but that's like a big factor of them um they looked at various androgens and gluc cortic cord receptors and they wanted to see like well maybe receptor density or Andor sensitivity is changing and in fact surprise surprise that's exactly what they found so they found both Androgen and gluc cortico receptor

01:36:40 concentrations were reduced and so you can start to see a picture forming which is like hm very similar to the insulin type 2 diabetes story where you've you've really put yourself in a very high stress situation so presumably epinephrine Etc testosterone releases are extremely high in response to that to try to reach back to some level of homeostasis you start downregulating the receptors for them and so it's like the signal can only get so high if you're going to keep that gas on we're going to

01:37:12 pull back the throttle and the receptor so that the total signal stays the same if that makes a little bit of sense well that becomes obviously problematic um so then like a final follow-up study here that that is it's important to not is they did another protocol which was really really cool and they said the first ones weren't enough so how about this we're going to come in every day for two weeks and we're going to do 10 sets of a one rep max every day so they were coming in and they would do 10 one rep Maxes every day

01:37:42 for two weeks and what what's really cool about that study if they didn't complete any of the repetitions they had to repeat it until they had 10 successful one rep Maxes on that given

day um absolutely brutal protocol I wasn't there at the time um they had finished that right before I got on campus but I was actually able to be around when they were doing some of the final analyses there of the tissue um what they want to look at in this particular study was beta adrenergic receptors which are those receptors

01:38:09 where that are going to be epine and such are going to be binding for so again similar story here um perhaps are we losing overall sensitivity because of this extreme sympathetic stimulation now actually thinking back what would have been pretty cool is if they had another group that did it and then did some down regulation breathing post to see if that can urate some of the problems but of course this was 20 plus years ago or something like that so um couple of things that happened is the one rep Maxes dropped by I think

01:38:38 around like8 kilos by the end of the two weeks uh if I remember right like the group average was something in the neighborhood of 151 kilos so these were pretty well- trained individuals and it went from rather I think actually it was about 160 kilos and they dropped to like 150 2 kilos something close to that what was more significant though was their power dropped by 35% which is really really interesting because if you pay attention to declines in physical performance over time and I mean that like through aging

01:39:12 what you'll see is people can hold on to muscle mass pretty well um it will go down by about you know 1% or so after the age of 40 however strength will go down at like 2 to 4% and then Power by 8 to 10% and if you look at actually World Records across strength Sports by age you'll see that they will decline by age but not that much however if you look at Speed Sports by age they fall off the planet so it's very challenging to preserve fast Through Time whether this is fatigue or because of uh age that's really important

01:39:51 because that'll then tell you hey a little bit of a in the coal mine is not necessarily your strength but your speed and so a lot of different techniques that we use to measure performance remember that's our Triad right symptomology physiology and performance um you're generally better looking at speed based performance tests rather than strength-based performance tests to get an earlier indication of potential uh overreaching or overtraining so anyways back to the the individual study there um in that same group again we we

01:40:23 had the same problem where it took some of them 2 to eight weeks to come back so what they had to do is I can't remember the exact time frame I probably should have thought through this but they they had to come back something like every week or every couple of days even after the study finished until they got back to their Baseline one rep max and some of them it took them up to eight weeks before they finally got back so they probably were in a classic overtraining State at that point which is was done in

01:40:47 as little as two weeks and this is also another point that people always ask like how uh like how long does it take is this something that has to happen over the course of months or or like if I were to go do two days or this intense training camp for two or three weeks could I actually cause over training and the answer is if it is actually truly enough volume and enough intensity you probably can do some significant damage in as little as two weeks probably doesn't happen that often most likely

01:41:15 you you're probably going to be reaching a state of nonfunctional overreaching but you may actually be able to put yourself in a position where it might take three or four weeks or more to get back to Baseline after a truly intense and again think about this protocol it's like totally unrealistic for the most part 10 sets of one of a one rep max squat every day for two straight weeks um some folks if you're extremely highly trained weightlifter you might do something like that when you're very close to say World Championships but

01:41:45 outside of that really specific scenario it's a totally absurd training protocol but that was the point right we were trying to ensure uh ensure that overtraining was met or close it's similar to when we've done we've actually done I think three studies in the center for sport performance on Dom's muscle soreness and in all those cases you do just like ridiculous leg extension protocols because you're just trying to ensure you cause super soreness if you don't then you have nothing to study so um absurd

01:42:15 training Pro protocols but but that's the point so nonetheless um as a result sure enough the beta adrenergic receptors uh were regulated by something like 37% um what's probably even more significant though was the sensitivity in those receptors was reduced by like two and a half fold and so it's like okay wait a minute we're becoming desensitized to this timei and we're also actually now starting to reduce our total concentration similar which is actually an interesting was a very sneaky smart

01:42:44 thing to do is they looked at nocturnal urinary epinephrine and guess what that was also up by like 50% 1515 5 Z 5 zero yeah and so now you're seeing this tie-in where it's like I'm seeing response at the tissue level I'm seeing a response probably although they didn't actually look at a pituitary anything like that I'm seeing adrenal and other endocrinological problems and then I'm also seeing this increase in concentration of vrine when I'm supposed to be sleeping and surprise surprise I'm having a hard time sleeping

01:43:20 um symptomology well that's uh a very interesting finding about nocturnal epinephrine epinephrine of course is adrenaline it's released from the adrenals no surprise there

but also from this brain area called Locus culus in the brain and the Brain tends to be called epinephrine in the body adrenaline just to complicate everyone's um understanding but that nclat did not come from us so don't blame us the point is that rapid eye movement sleep so called REM sleep is more abundant in the second half of the night we know that the

01:43:52 dreams associated with rapid eye movement sleep are more emotionally Laden and that those dreams and those emotional states are actually important for discarding the emotional load of previous days experiences it's a sort of a uh natural trauma therapy if you will because in the normal healthy State those dreams are associated with an inability to release epinephrine at night so for me what you just described first of all it's the first time I've ever heard of it um uh but it ties together something really uh quite clear

01:44:29 from the Sleep Neuroscience literature which is that when people are stressed they tend to get less rapid eye movement sleep that rapid eye movement sleep normally is associated with low levels of epinephrine so whether or not it's causal or not isn't clear um but sort of doesn't matter for sake of this discussion but what I'm wondering and I suppose one could test for but maybe observed is whether or not people who are over in overtraining too much overreaching too much because of this elevated nocturnal epinephrine

01:45:00 diminished REM sleep whether not their emotional state is also um disrupted because one thing we know for sure is if you want to disrupt somebody's emotional state you deprive them of sleep and rapid eye movement sleep in particular the one caveat to that is for those of you out there that have heard that rapid eye movement sleep deprivation deliberate rapid eye movement sleep deprivation is a treatment for depression that is true but it's coupled with a next night enhanced rapid eye movement sleep so one of the major

01:45:30 takeaways from all of this uh that I'm realizing is that no surprise daytime activities impact nighttime endocrine function impact quality of sleep impact daytime activities yeah actually there's there's so many fun things I want to do here now um this is actually why measuring eye movement is a very fantastic tool for understanding total stress load and you can actually differentiate different types of stress so caffeine use versus alcohol use versus sleep deprivation by actually measuring eye movements that's actually

01:46:02 what we do in our absolute rest sleep company is in addition to getting a a full PSD sleep study done in your bedroom you're going to get an eye tracking assessment which we're going to be able to figure out why you're getting there so um nonetheless yeah if you actually look at the classic signs and symptoms of overtraining or overtraining syndrome it's going to be everything from performance decrements like we talked about um resting heart rate is going to increase uh you're going to see things like HRV drop by generally 20 or

01:46:32 so percent that would be a very large disruption in HRV um decreased body weight and then all the stuff Andrew y just talked about so motivation adherence appetite mood um all of this stuff are are classically known associations with with overtraining and that's for the exact reasons you're talking about sleep disturbances and disruptions um wanting to train motivation all of this stuff uh goes part and parcel with non-functional overreaching and or overtraining um you can actually tie this back in a little

01:47:03 bit more to some other biomarkers and this is this is great because this is the stuff we look for this is the the physiology stuff we look for um you've probably talked about shbg before um which is the sex hormone binding globulin so it's this protein that that'll float in your body that's going to bind up sex hormones in particular testosterone so what happens with um overt training is you can actually take this serly like week by week and you will actually see this number rise and so if you see this like say you're using

01:47:33 a a a service like inside tracker and you're getting your your blood measured every so often and you see this numers start ticking up this is actually associated with that because what's actually happening is it's binding up all your free testosterone and that's just leading back to the circle we're talking about and you can actually see the same thing happen with calorie restriction U just not eating enough calories but in this particular case because it actually happens in both scenarios you know it's not an issue

01:47:57 simply of being underc calori it's clearly an issue of the training load being too high so just to give another little tool there's uh I can get the link for it but there's a a website that um was created by uh which Journal oh slipping but I'll get it to you you can link it up where you can actually go in and plug in a number of values from blood chemistry so if you got your blood work done and you can plug in your pre number and your post number so say you got it done and then maybe 10 weeks later you got it done again and you're

01:48:28 wondering and you notice hey my free testosterone's down or my shbg is up is it actually a meaningful number and you it will actually tell you whether or not the change prepos is physiologically Meaningful or not or just within the error margin of the measure um and you can actually change like like right there on the website you can change your confidence interval so it's really really cool if if you know if you just have your own blood and you want to know like hey I had any level this year and

01:48:54 now it's you know here over there it's just a totally free resource um created gone through peer review all that stuff um and I'll give the link to that so that's a pretty cool um measure

in addition to that like probably one of the more powerful and easy metrics uh biologically is to take your cortisol and dhaa ratio so this is known to be associated with a lot of things um you want to be really careful you don't want this number to be too high or too low something like 0.09 is about cortisol to DHEA DHEA to

01:49:25 cortisol ratio yeah DHEA to cortisol I'd love to tell you I said it backwards on purpose just to make sure everyone understood but I got it backwards yeah I mean this ratio has been associated with so many things um you have to do you do have to be careful with Association right not being causation but everything from risk of infections some metabolic health and and like other disease States as well as more what we're talking about which is hey am I am I am I getting sort of cortisol this regulation which is what a

01:49:53 lot of folks would call you know again adrenal fatigue and know that's not really what's happening but if adrenaline and epinephrine are off and testosterone cortisol is going to be along the right and so you can also look at things like testosterone to cortisol ratios um so there's a lot of things you can glean here to give you some insights into where you're going if that um if that ratio is too high that's going to be associated with metabolic syndrome and a bunch of other stuff if it's too low that's going to be associated with a

01:50:23 lot of cognitive problems like um aggression and mood and and a bunch of things like that so again you want to keep it right around that 0.09 ratio and and most of the time actually in some blood chemistry stuff you'll get a you'll get a report of that or you can calculate it pretty quickly I'm sure we'll get into this in the episode that comes next on uh nutrition and supplementation totally what about compounds that lower cortisol such as ashwagandha um I can see now based on the L you're spelling

01:50:53 out that during phases of a lot of intense overreaching or frequent overreaching given that those compounds can indeed lower cortisol rodol rolia rosacea Rola Rola Rosa um fun word to say um two words but the first one more fun to say Rola Roda Rola Rosa riola Rosa folks and ashwagandha um I've been uh trying riola recently um and mainly as a buffer to uh output um it does seem to have some good data attached to it related to lowering uh one's perceived threshold of how hard they're working so

01:51:42 in other words you can work harder um and not feel as if you're working really hard which allows you to do more work that's sort of the subjective description of how it works but you told me that it um Can blunt cortisol and and ashonda we know blunts cortisol both of these things of course can do other things but are these um compounds that you sometimes will incorporate into uh a training regimen uh I I've been using rodea for probably six or more years like pretty consistently not personally

01:52:08 but uh using it with the individual we work with you do need to be a little bit careful uh I wouldn't say that it blunts cortisol it is probably more appropriately described as a cortisol modulator uh which means sort of if it gets too high or too low it'll help kind of keep it within normative range um there's also there it is important to note there have been a handful of studies two of I know specifically showed that riola use can enhance strength gains however it may reduce muscular endurance so um we need more human data

01:52:41 on this stuff and it may turn out that's not a concern it may also turn out to be a concern so nothing is nothing is perfect and free there's no supplement that is a Panacea and um I have used again rodol in a lot of situations because the other thing you kind of have to pay attention to the cortisol is is you have it's supposed to be modulated throughout the day it's not supposed to be at this normal value in fact if you look at normative values um it's typically uh described in um uh micrograms per deciliter and depending

01:53:12 on literally what company you used to draw your blood if you're getting it through the blood uh depending on what which method they use to analyze it the normative values are like frankly embarrassingly all over the place um they're mostly going to be like 5 to 25 as a quote unquote normative value but that's outrageous we also know those numbers vary massively by age by sex um and throughout the day and so if you only are taking a single point let's assume you're doing a fasted blood draw which is what most folks do it's really

01:53:45 only going to tell you a lot about what's happening in that moment we need to know well like maybe let's say my cortisol was if I'm a say 38-year-old woman and my 7 A.M cortisol was you know 15 milligram per decer that's pretty good but if it's 15 milligrams per deciliter at 3 p.m. oh boy I'm I'm probably having some issues right so there's a change throughout the day and you need to be able to plot that curve so you can actually well pretty standard practice that we do is we look at cortisol throughout the day we're going

01:54:16 to take multiple markers because I don't want to just see your Baseline cortisol I want to see this curve throughout the day that's going to tell me a ton about U again is your sleep being caused by this regulation um is it your training is it something else so I would like take a single Baseline blood marker of cortisol with a lot of grain of salt we we typically measure it at least three times throughout the day so something like 6:00 to 9:00 a.m. 12:30 and then something like closer to the evening

01:54:46 oftentimes we do much more we'll do like seven points or something like that throughout the day depending on the situation so you want to be careful of that um just since we're

here you can also get cortisol in uh through saliva and now there's sort of pros and cons to that because the the pro of doing it in your blood is it's it's much more stable um saliva is extremely responsive to whatever happened these seconds before you took that test the upside of it though is you can do a bunch of real

01:55:15 world life experiments so for example we will do this sometimes if we want to see how an individual is responding to a given stressor let's take it right let's take the take it in the you know spit into a tube we're going to take it and then we're going to go do this workout or this cold exposure whatever we're going to do take it at thean we know that it's responsive to what just happened but that's the point um so you can actually there's sort of pros and cons so you'll use the appropriate measure for the appropriate

01:55:40 uh question you're trying to answer yeah a couple of points and Reflections about cortisol my first uh laboratory Duty as an undergraduate was in a was actually in a biopsychology lab at the time they didn't have the field of Neuroscience as it's now called it was called biopsychology or psychobiology I didn't know that no there was used to be neurochemistry neurobiology they had all collapsed into what we now called Neuroscience which was only some years ago but my job was to collect cortisol samples which means I I was collecting

01:56:07 um spit which means I was collecting saliva and the an advantage of saliva based cortisol it's free cortisol it's the active form as you mentioned it's reflective of what happened in the seconds or minutes um just prior a couple of things about the regular cortisol pattern across the day because I realized that while it wonderful for everybody to get their cortisol measured in detail multiple times and blood and and saliva and so on some people just won't do that uh for whatever reason or can't do that yeah and the basic Contour

01:56:34 of a healthy pattern of cortisol secretion is uh to have highest levels of cortisol in the morning um is actually part of the mechanism that's associated with waking you up viewing bright light ideally from sunlight but other forms of bright light early in the day actually can lead to a 50% % increase in that qu cortisol Spike which is a good thing people here elevated cortisol oh no this sets in motion a Cascade of things related to enhanced mood and alertness immune system function Etc what I think it can be

01:57:02 useful for people to understand is that many things will Spike cortisol throughout the day stress cold water exercise but the idea is that it comes down to baseline or near Baseline um rather quickly one of the worst situations as you pointed out is when the highest level of cortisol is consistently shifted to the afternoon period in fact that's a um pretty reliable signature of certain forms of depression this is worked by U my colleague David Spiegel at um Stanford Psychiatry and the the great Bob spolski

01:57:33 Robert spolski of uh why zebras don't get ulcers y behave Etc and fame lots of lots of popular books there um I think that if people are trying to regulate their cortisol and they're just under and they just understand that basic Contour that the Baseline should be uh you know rise pretty quickly after one rise in the morning so it's easy to remember rise rise um rise out of bed and Rise cortisol with light um bright light with exercise um with caffeine these things will all increase cortisol and then across the day it's normal for

01:58:04 cortisol to spike but then to use some of the down regulation methods that you described in particular the breathing methods and exercise itself as the case may be but then to really pay attention to how much psychological and physical stress is occurring in the six hours or so or eight hours prior to sleep um does that seem like a a good sort of broad Contour of how to have a healthy pattern of cortisol released because you actually want the cortisol to reduce inflammation and initiate or participate

01:58:30 in the recovery process you will not see any progress from exercise training without a large spike in cortisol it is critically important when we think of phrases like cortisol inflammation stress this is not bad right physiology is not personified right there the things don't like hate you in the body right it is all is not good and bad they just are um the more you try to suppress cortisol the more you suppress adaptation what you want is exactly what you mentioned large spikes meant with large quick recovery and you want to do

01:59:05 that throughout the day and get that hor medic stressor this is so to going back to your ashwagandha and Rola issue um it I think it would be very shortsighted for people that do that as this is a prophylactic okay because you if you blunt cortisol you're going to cause immunosuppression especially early in the day totally taking on to before going to train is is counterproductive yeah we do not just this is not a baseline part of our foundational package right if you go look at the um athlete foundations or the athlete

01:59:33 resilience protocols that put together you're not going to see these things in there for that specific reason um any form of cortisol regulation needs to be done strategically if you are excessively high and we're bringing you back down to normative values at the right time then great if you're normal though then taking you down lower than that is actually problematic that's the same thing is actually true since we're here for oxidative stress forign inflammation antioxidant use um we mentioned I think earlier about taking

02:00:01 vitamin C and vitamin E post exercise will actually blunt adaptations or at least has the potential to do so same thing right if you're modulating this response just because and you have

not done so because of actually biological testing that indicated you needed to do such then you actually may be making things worse and so um we we see constantly with people who take a number of supplements and substances for sleep and then they wake up the next morning groggy and your cortisol suppressed

02:00:33 okay great so then they take something for stimulation and then the rest of the day they're trying to reduce and then you're this nasty cycle instead of just getting out of the way and letting cortisol do what it's supposed to do U and then making sure again you're teaching it so this is actually a coachable response you can coach your own body to go down in the later part of the day and go up in the earlier part of the day you want to make sure that you are driving that train with intent and so again to reiterate if you don't need

02:01:02 that you shouldn't do it right if you don't need to lower cortisol you shouldn't walk around doing it you're just going to suppress the state even far and this is what's needed this is needed for anabolic responses so you're not going to grow muscle if cortisol is not spiked it's going to compromise it rather so you want to be intentional with these practices uh especially in the form of supplementation be very very intentional I've heard it said that carbohydrates in particular starchy carbohydrates definitely can inhibit

02:01:34 cortisol definitely and uh this could be through the uh tryptophan amino acid related pathway that ratchets up to uh serotonin release probably some other things too I mean the idea that carbohydrates just stimulate serotonin is a little bit uh overly simple cellular mechanisms amk going up and immediately turning on there yeah right so um you know I think we've all experienced this uh you know we're stressed we're stressed we uh doesn't necessarily even have to be highly processed you know uh fat assoc you know

02:02:06 fatty carbohydrates um you know like potato chips and and potato chips and dip or these kinds of things it can also be a bowl of rice a bowl of oatmeal a bowl of pasta um which here I'm not trying to demonize um carbohydrates I do ingest carbohydrates um minimally or non-processed carbohydrates um most of the time but not all the time and they have a fairly potent uh effect on lowering stress and perceived stress and even quality of sleep which is not to say that somebody has to load up on them

02:02:37 like crazy unless their glycogen is really depleted talked a lot about this in the endurance episode I know we'll touch on it more in the nutrition supplementation episode but um in thinking about the relationship between carbohydrates and cortisol and what we've just been talking about terms of cortisol as being vitally important for the adaptation Trigger or triggering adaptation it's probably a better way to put it but that it can blunt cortisol taken post training or um maybe in the evening before sleep what are

02:03:08 some of the basic ways that one can think about and maybe use carbohydrates in specific ways in order to let's say control cortisol rather than uh quash cortisol uh you actually have alluded to a number of times already so we often times will give people a lot of carbohydrates at night for some of these reasons you're going to feel fantastic a lot of people that helps you sleep um both get to sleep and stay asleep Sleep Quality you talked about specifically remember think about it this way cortisol at its core

02:03:43 is an energy signaling molecule it says we are in the need for energy great um epinephrine the same you you'll start seeing for example cortisol will liberate uh free fatty acids put them in the bloodstream getting you prepared to do something the problem is if it's continually elevated throughout the day with no down regulation we start running into issues right so again this is the differentiation between oh my cortisol is slightly elevated all day versus I had a really big big spike after training I had a really big spike

02:04:14 after breath protocol Etc and then it went back down so that being said if you then ingest carbohydrates you are telling it is quick to see the sign all we have nutrients we have energy again specifically carbohydrates therefore cortisol can sort of go back down we don't need to be liberating free fatty acids and preparing uh the need for fuel so you can help yourself go to sleep for many as you pointed out many mechanisms actually of why carbohydrates will help you sleep at night for some not all

02:04:39 people but some that would be one of the relationships it has with cortisol great I look forward to hearing more about how the various macronutrients and micronutrients and so-called adaptogens this very mysterious group of compounds you know the word adapt gets thrown around so much nowadays um but as long as we're talking about adaptation I think uh that'll be fair play for the uh discussion in the next episode about nutrition and supplementation in my laboratory when we study stress we use a

02:05:08 number of different markers subjective reports of how stressed people feel uh heart rate mnning heart rate heart rate variability cortisol free cortisol and on and on what are some of the other markers of stress as it relates to exercise adaptations and Recovery because once again I think we're seeing a lot of parallels between the study of psychological stress and the study of physical stress as it relates to exercise adaptation remember in terms of physiology stress is stress this is why we have this cool

02:05:43 term of alistic load or allostatic load so it's that it really doesn't matter which system you test for it will reflect overall stress uh you you mentioned several of them we've got done talking

about some biomarkers HRV and heart rate are another great example because what you're trying to do is this when we were talking about the muscle soreness thing what we were really getting at was a marker of how do I fix the overuse in that particular muscle now we've really transitioned into Global markers of

02:06:14 overuse and why these are problematic or important to pay attention to rather is again these are the indicators that you didn't just work a muscle out too hard but you have actually done something where you've compromised all of your physiology to a level where you've influenced a circulating catacol amine or something that's going to influence multiple markers now like your sleep and your mood and your behavior so that's why these things are problematic that said you could look at resting heart rate not

02:06:41 a bad thing to do however that does have multiple downsides uh one thing we do know is your resting heart rate will Elevate with excessive stress load this actually doesn't matter if it is physical stress or psychological stress or a combination so you will see that number drift up over time here's the downside though it's not tremendously sensitive to smaller stressors uh in other words if you were to do something like alcohol is a very good example you will see your resting heart rate Elevate

02:07:09 with alcohol use um excessive tobacco use and psychological stress however if you do something smaller like a hard training sessions resting heart rate is not sensitive enough to pick that up it will actually probably stay the same so for those reasons we don't actually use resting heart rate that much we will take it but it's not our primary indicator that being said HRV is a better use so just really quickly for those that are not familiar uh your heart rate uh let's say for example you your resting heart rate is 60 beats per

02:07:38 minute that means every second it's beating it doesn't actually happen on a consistent Rhythm such that it would beat on second one beat on second two beat on second three Etc the rate is more variable so it might go beat beat beat beat beat be there's a variation in the heart rate and at the end of that 60 seconds in this example you would have still completed 60 beats they just aren't on the exact same pattern well one thing that's actually quite interesting is the amount of variation in your heart rate is actually

02:08:09 associated with your overall sympathetic or parasympathetic State such that a large variation so an arhythmic pattern is generally more representative of being more rested and recovered and being more parasympathetic and you'll notice during times of extremely high stress uh you will be very rhythmic beat beat beat beat beat and so this is a little bit of a confusing idea but a high HRV is there indicated of a lot of variation meaning you're pretty recovered a low HRV meaning there's not a lot of variation means you're probably

02:08:44 pretty stressed and wire so it's it's uh related to heart rate but in my opinion it is a significantly better marker of that now one thing you want to pay attention to if you do this a couple of things there are some accuracy issues with many of the devices basically everybody at this point probably has some device uh that's telling them their HRV what you do not want to do is simply compare your number to somebody else for a lot of reasons not all of these Technologies are actually even measuring

02:09:15 the same thing um again some of them are actually combining with other metrics and calling it your overall Readiness or your recovery and so now we've what we've actually done is made a couple of assumptions and then stacked them on a whole host of other assumptions and then gave you a number and you don't know what that sort of black box score actually even represents so I would caution one against taking too much uh information from that if you are actually measuring HRV even within that there's a lots of ways to calculate it

02:09:41 that are not important here so don't necessarily worry about the score compare it to yourself but not to others what you will see is if you use similar devices and techniques it's hard to find data here but in general people that are uh overweight um might have a little bit of a of a lower score as in a worse score um we need more information on that to be clear so in large part the best way to use something like HRV is to measure it under the exact same circumstances every day so whether you're going to use um just a device uh

02:10:18 on your watch or your phone or your bed or anything else or you're going to buy a special HRV on it's fine just take that measure at the same time um mostly this means first thing in the morning so you wake up you go to the bathroom you come back down take your measure or something like that you don't uh wait sometimes you took it before food then after or look at your phone like all these other things that can influence stress so so take it it usually takes somewhere between seconds and minutes to

02:10:43 record so you want to pay attention to that now one of the things you'll notice is there is a natural change in your HRV that just happens and so what you kind of really want to pay attention to is I guess answering the question of well how much of a change in HRV has to happen before I should care and it's hard to answer right so let's just say your HRV was 100 I just made that number up what if you wake up tomorrow it's 99 what's that mean well I don't know if you wake up tomorrow when it's 20 that's probably

02:11:11 a bad thing well where's that line it's hard one thing I would recommend doing is taking your HRV for at least a month before you start using that value to make any changes and you

recommend taking it first thing in the morning yep always at roughly the same time basically under the same circumstances it doesn't have to be technically in the morning but because your day will change on most days what you get into um that's the most stable thing in your life so I would take it then and I would collect

02:11:37 it for at least a day at least a month rather maybe even six weeks and then give yourself basically a running average so what we quite honestly do is uh we will actually track it for forever and then what we always look at is what does it look like today relative to the last week on average and then what does that look like to our historical average and we always compare those things um and you also want to make sure you compare like to like so in other words I generally I'm not going to worry about

02:12:07 today's HRV score relative to tomorrow's what I want to look at is today's relative to this exact same day last week um not for athletes but for non-athletes this is very important so imagine don't worry about the difference between hrb score and Monday compared to Tuesday pay attention to Monday compared to last Monday and the Monday before that that's because you typically have the same sort of weekly schedule and what you don't want to do is is say look at Monday's HRV score which is a reflection of what

02:12:35 happen Sunday and compare that to Tuesdays which is actually a reflection of what happened Monday you probably didn't do the same stressors on Sunday as Monday so you're not actually comparing the same thing but if you have a General weekly schedule you're likely to compare this Monday's or to the last Mondays because they're both comparing what happened on the previous days see did that sort of Distinction make sense absolutely I do the same thing with body weight by the way if you're trying to

02:13:00 track body mass gain or fat loss or something compare like the like you can look at the daily changes but you need to pay attention to what that normal distribution is so if you kind of do that you know Monday to Monday thing that'll give you a rough area of saying okay my normal weekly variation is say five so my average is 100 but I will fluctuate between 95 to 105 that's my standard deviation is sort of a science dorks would call that um if you start very uh changing more than 5% outside of your normal standard deviation then I'm

02:13:31 going to start paying attention a little bit and I'm going to actually run a little bit of an algorithm on this one and so here is my thinking process when I get HRV really any metric but HRV is is the example we're using First Step did I collect good data and what that I mean again did I measure it the same way I measured every single day or did I get up and look at my phone first and I realized oh crap I forgot to take my HRV and then I went back and got there so say I had a 15% derivation from my

02:13:59 normal number and then I realized oh yeah that's right I was up super late last night doing whatever okay great I'm going to consider that bad data you didn't good if it's bad data then I'm not doing anything ignore it's bad data and you throw it out you don't use it if you decide for the most part let's assume it was good data okay great then I'm going on to my next question which is is is it acute in other words is it just today right or is it chronic in words this is a is this pattern been happening for more than five days or at

02:14:29 least three out of the last four or something like that three minimum is what I like honestly I generally look at five or more days that's a very big distinction if it is something that just happened today then the next question I'm going to ask myself is and I in that adaptation phase am I trying to be in a phase where I'm trying to cause insult to the body that it needs to respond with if that is the case I'm just going to ignore it right in fact it's almost sometimes a good sign hey we are stressing the body and it is

02:14:58 stressed what we're doing is working amazing in fact if you don't see that it's sort of like maybe we're not doing enough to push the pace all right so great if the answer is no we're in a peaking phase then we're actually going to use what I call acute State shifters so this is a whole host of little tricks that I have that can change HRV or any recovery metric Within seconds again these are not chronic fixes this is just I'm having a bad day today I feel like crap can I make myself feel better right now and so I kind of

02:15:32 call these parlor tricks a lot of the times and there's a thousand of them we are certainly not going to go over them but I'll give you some examples um you can pull out first of all physical movement we'll do it you you'd be stunned how just doing some yoga moving around doing some jumping jacks starting your workout I mean you probably experienced this it's sort of cliche in our world at this point but um if you ever do any serious lifting over a serious amount of time there will be days when which you walk into the gym

02:16:00 and you feel awful and somehow that day you said a lifetime PR yeah that's a strange strange phenomenon yeah I uh I I've experienced that more than a few times um it's rare the inverse is rare however you feel great you have a horrible workout it happens yeah um and it can happen for any number of different reasons but yeah I think the the former when when isn't feeling very good and then somehow it's a terrific workout does set a kind of a seed of Doubt as to how good our subjective assessments really are and which I guess

02:16:37 is why we were talking about um objective assessments yep like HRV and remember if it's a single day here uh you can even do hard training uh people sort of have this idea like well if

you get up and your recovery score is down do a lighter day that's probably like I'm probably never making that choice to be honest not in this situation remember this is one bad day and we are in a phase of even trying to improve performance right now like we're probably still training hard you will again often see I felt terrible

02:17:07 then I trained super hard and it totally changed my day around this all can happen so exercise is my first love here um absolutely breathing um any sort of up regulation breathing so we talked a lot about down regulation breathing just do the opposite right and so this is when hyperventilation strategies can work uh instead of accentuating the exhale you accentuate the inhale or you restrict the exhale this is working in the exact opposite situation you can also play little this is where things

02:17:35 like music motivational quotes um if you're the type that follows people on Instagram that motivates you or can work with these things um coaching tactics these can be things like um finding out or talking about that person's why um you sort of shared something that a mantra you use um when you're training hard to keep you go better I'm not going to ask you to share that now but some people have this sometimes right or you may have this conversation with your athlete we call this finding out your

02:18:05 why right so finding out like why are you really here what are we doing here and a lot of times you'll hear things like it's because I grew up poor and I don't ever want to be poor again okay great well this is for my children or like any number of things and you can pull that out on these days you need to be really careful this is why I call these parlor tricks because when you play that card too often it starts to lose effect right and you can only dig to a hole so often before it's sort of like a um the same thing is with music

02:18:34 right if you every time you go to the weight room it's blasting death metal at level 10 well eventually it's not it's no longer motivating right it's no longer helpful so um you want to deploy these things strategically yeah the the phrase that comes to mind is signal to noise you know the nervous system especially the dopamine system and the adrenaline system which are part of this larger system called the catacol amine system so that's dopamine epinephrine norepinephrine the the get up and go

02:18:57 focus on external goals um movement Associated it's and on and on that that system responds best to high signal relative to noise so if you're as you pointed out um listening to music every time drinking a ton of caffeine energy drinks pre-workout New Tropics and then you know stacking all those things uh sometimes refer this as dopamine stacking informally referred to as dopamine stacking you're doing all those things then you first of all then you're wondering why later that afternoon or the next day you're feeling like you're

02:19:28 you're under a cloud well it's obvious your your cacing system crashed but it's also that um you don't necessarily become dependent on it it's just that you start to wonder whether or not you have the internal mechanisms and motivation to train without those things and so one tends to use them more and more and then they have a diminishing effect over time um the rule that I've been um sort of applying has been I never do two workouts in a row where I'm stacking in um stimulants loud music and any kind of uh sort of high potency

02:20:00 inspiration however every set in the gym or when I run I really try and be diligent about form and attention to what I'm doing the one exception would be the long duration endurance work part of the reason I do that work is to let my mind go into states of drifting uh not trying to think in complete sentences or even close to it just let my my brain kind of idle at at a low hum uh and for that reason generally listen to something that's more of a story or don't listen to anything at all and just

02:20:30 let my thoughts kind of spool through anyway I don't want to take us too far off track but I think this um idea of signal to noise will resonate with the engineers out there but since most people are likely not Engineers it is the way that the nervous system works um evidenced by the fact that whatever area of your body right now is in contact with a chair or um any other surface that's been in contact with for more more than a few seconds you forget that it's in contact with it because there's

02:20:54 low signal to noise at that point a similar note you actually mentioned stimulants basically there whether you're talking caffeine or any other stimulant any other cortisol modulators or adaptogens any of these things fall in the category if you're not using them consistently and you're having a rough day and all of a sudden you throw down 200 milligrams of caffeine uh it's going to change real fast the equ strong performance enhancing effect yeah absolutely and for these reasons right um so we mentioned a couple of them

02:21:20 breath work um food more calories just eating some food uh sometimes we'll give people like what we call Comfort Foods so this is just like hey you're uh you know you're from Georgia and we know you love grits so we're having grits for breakfast oh my great like just something to change your mood acute State shifters um to alter it the other couple of Tricks here are light so if we know that maybe say multiple people are struggling that day maybe we'll put on the lights extra bright we'll bring in some extra things

02:21:50 and just get it more light in the area not that do even count actually going outside and seeing the Sun but perhaps we'll do that um and then other little tricks that I've learned over the

years is one particular thing I love is literally drawing a line a physical line in the ground and you look at that line and you say like I'm going to train today and I'm going to accomplish this effort uh I'm not going to walk past this line and into that training space until I'm ready to give that effort and that may take a minute

02:22:21 or 10 or whatever but it it's the physical barrier is very important to saying like I'm not just going to get through it I'm going to actually perform the way I want to perform or I'm not going to do it and I'm not going to cross this line until I'm ready to make that happen all right I really like that tool it also brings to mind the importance of at least thinking about how your relationship with your phone during training um Can perhaps help but also impede workout motivation and performance in an earlier episode you

02:22:52 mentioned that if people are using their phone to play music during their workout that they establish the complete playlist prior to initiating the workout and then not deviate from that playlist as opposed to changing it in the middle because there's just too much of a uh of an Impulse to also check social media check email check text messages I mean the way I think about the phone actually is it's a bunch of little um brain areas it's got a memory system for you it's got lookup tables for lookup tables it's

02:23:22 got websites to look things up on the Internet it's got photos I mean it is so rich with sensory data and it's so closely linked to our own brain architecture the algorithms are designed for those to be that way that I always think about it as bringing in a second person with me but that person is a my twin that um has severe attention issues and for those that already have attention issues just think about this as a twin that would then compound You by tapping on your shoulders talking to you all the time interrupting you uh

02:23:53 somebody that you like a lot but that frankly is um is a little bit irritating in that they're they're interrupting your ability to really show up and also your ability to show up for them so I started to think about the phone as um an entire individual and that it represents me and and certainly not the better version of me exactly you actually mentioned something else that we use uh occasionally which what we call Brain Games or puzzles whether this is a crossword puzzle or something where you actually

02:24:22 lose your thought of self for a second and your brain gets engaged in a task that you weren't regretting or even thinking about these can be stupid little games uh it could be little challenges especially if you're in like a group or a team setting right like we're going to play one round of vge ball or we're going to play one round of of Thumb Wars so you do encourage this yeah I see so you would play like a thing instead of warming up like all right get in and everyone get going we're going to you know get your foam

02:24:47 roller your D whatever things just like all right everyone line up and we're going to play thumb roll to see who wins right just like whatever right and all a sudden you've snapped into a new mental shift um or literally playing brain games playing Tetris on your phone like any of these things um can work in this acute setting C can I ask you a question it's not directly related to recovery uh per se but I think it's worth mentioning um or asking about rather which is the use of mirrors or no mirrors while training um you know

02:25:17 the experience of seeing oneself and observing one's form in the mirror I suppose has some utility you can get some sense of progress that you might trigger um here I'm almost specifically referring to uh resistance training I suppose it could be cardio if you're running on a treadmill or pushing a sled or something but um you can see form um you can get a sense of um what your face looks like when you Grimace uh but in all seriousness um you are without question a person not you Andy but um one is in a

02:25:51 interceptive mode when looking at themselves in the mirror so exception perception of things beyond the confines of our skin even if it's a picture of us interoception perception of everything from the skin inward um and so if we're looking at ourselves we're diverting some allocation of our attention let's say there's a hundred these are arbitrary units and you can think put 50% of your attention on the feeling in your body or the muscles you're training um and 50% on how it appears in the mirror or it could be 100% on the mirror

02:26:22 100% internally which you best accomplish probably by closing your eyes so obviously there are constraints here certain movements you wouldn't want to close your eyes Etc in general what are your thoughts on mirrors or no mirrors for resistance training specifically it depends on the metric that you find most important and what I mean by this is if you're training for say muscle hypertrophy there's emerging evidence that suggests uh actually looking at yourself in the mirror and even flexing in between sets um can actually be

02:26:51 advantageous or it can augment muscle gains oh my there's uh support for all the the uh mirror flexers absolutely not not making fun of you I just uh it is is sort of interesting to be on the observing side of of that but Hey listen results are what people are after yeah having said that if you're trying to enhance um movement learning then it may be detrimental so if you're doing an exercise that is explosive and fast it's probably not the best thing to be looking into a mirror um if you were to

02:27:21 walk into any Olympic weightlifting Arena and you had any thoughts of using a mirror you would probably run out of the gym very very quickly you can't see yourself in time to make an

adjustment with the movement that's happening that fast and also we'll do exactly what you mentioned which is it will remove your ability to understand and feel the movement and so this is a big component to using technology for exercise at all is you have to make sure that the end point is you understanding you and your

02:27:52 physiology more not less when you Outsource learning to technology in this case even if the technology is the mirror you remove your ability to gain and truly understand that learning process so you need to be very very careful whether you're using a mirror or whether you're using any number of apps where you can record say a movement and then watch it afterwards and it will give you a breakdown if your hand was in the right spot or foot was in the right spot spot these are all great but you need to then take the next step which is

02:28:24 to say I need to be able to feel that position all right so in the case of performance if you can imagine trying to learn a new technique say running technique and you have to be able to watch yourself in the mirror to understand your stride in the right position if you don't take the next step of saying okay now I don't have to look in the mirror and I can feel when I'm getting out of rhythm or whatever the cas is then you'll never be able to actually then use that in your race and so it's very very important that people

02:28:49 again pay attention to what is the dependent variable that you're actually interested in doing if you're trying to get better at something the tech is okay as a starting place it just cannot be the finishing place thank you for those Reflections I'm curious as to what happens or what one should do if their HRV is reduced for maybe three or four or more days in a row absolutely the next question that I'm going to ask is and am I in that adaptation phase if so I'm going to still ignore it just like I

02:29:18 did if it was a single bad day but I'm going to start watching it very carefully I may actually now introduce some other tests so I may use a performance test uh we may look at something else maybe ask questions maybe have some communication either with myself or somebody else so I'm going to start paying more attention but I'm still really not going to take much action until that crosses more than seven days of consistent problems um if it does do that or we're in a peing phase then I'm going to go to another

02:29:49 set of solutions that are truly going to pull me out of the hole rather than just be uh those acute State shifters these are more what I call chronic state shifters now some of these are actually very similar to the ones we've used before uh for example thermal stress so I can promise you if your recovery score is in the tanks and you walk outside and you jump in your 35 degree water and you get back out what's going to happen is your HRV score immediately afterwards I'm I'm talking Within seconds is going to be

02:30:22 significantly compromised right in other words think about that remember a low HRV means High sympathetic I promise you cold water will put you in a high sympathetic Drive however and we've tested this pretty extensively um looking at HRV zero 15 30 60 90 all the way up to 180 minutes post and on average you will see your HRV score continue to rise after that and so well you have this immediate sympathetic response you will immediately then respond you know about 30 minutes on most people depends on the person though

02:30:59 and that score will be improved for several hours afterwards so um heat can kind of have a similar effect um that actually again is a it's sort of an acute fix but over time as we've described earlier that can also have a little bit of a chronic effect um we can also then get into areas like sleep and so now we're going to start playing and exploring why uh are you sleeping poor as well or was your sleep score fine but your HRV was low that's a little bit of a different answer if your sleep is getting compromised then we're going to

02:31:31 start going into and making sure we're improving our sleep um in terms of like brain stuff instead of maybe playing a game or having music or some of those other tricks those aren't going to really have a chronic effect but you can do things like work on social connection that's actually been shown to improve recovery over time you can do things like journaling or meditation and those have an acute effect as well as a chronic effect so again if you go Journal right now you probably feel better but also we know that over time

02:32:03 that will gradually improve things so um adaptogens and things like that also can have a chronic effect so can things like electrolytes or food or hydration if those things were off so we're going to go to a whole number of areas but those are the primary ones outstanding of all that of course it may be simply a time to go back and reassess our training program that's truly the case so uh that's where we're at if so we're probably going to either completely remove training um or drop it to like 50% or so

02:32:37 uh until we start rebounding back to Baseline and that's generally the numbers we use for many people who are not training for a competitive Sport and maybe aren't pushing themselves really hard you know maybe uh they're they consider themselves somebody who exercises in order to maintain Health um and Aesthetics and um longevity Etc uh and they never really finish any workout completely exhausted they're sleeping okay their appetite's okay can we assume that they are recovering well um or maybe they're

02:33:18 not creating enough of a adaptation response like there's no Progressive overreaching and so there's really no stimulus for Recovery what I'm saying here is on the face

of it I think is obvious right if you don't train hard there's nothing to recover from what I'm really saying is is the ability to recover itself something that we need to train in other words can we get better at recovering and the uh analogy here would be something like focus in order to uh perform work of any kind but certainly mental work and

02:33:53 physical work we need to be able to focus the ability to focus is the reflection of a bunch of neural circuits and chemicals and hormones Etc but we know roughly what those are and we know that if you are poor at focusing for every small bit of time that you can focus a little bit longer even if it's a matter of seconds those circuits themselves get better at focusing and so on and so forth so in other words is the recovery system however Broad neurotransmitter hormones neural muscular immune-based Etc can that

02:34:25 system or set of systems become better can we get better at recovering can we meaning can it become faster and uh more effective um can we think of the recovery system is kind of a blade that gets sharper by engaging recovery because if so then there's strong reason for people who are not pushing really hard to push at least a little bit harder than is comfortable for them every once in a while to make sure that system doesn't start to slide back remember physiology is listening to everything you do and it is always

02:34:57 responding so the analogy that I will meet your analogy with that I use here is the bowling alley so you've probably been bowling before and you've used the bumper Lanes right the bumper Lanes I've gone bowling before and I've spent time in the gutter and I've spent time on the pins okay um it's been a while we used to have a bowling alley in the town where I went to and um it was fun we used to slide around on the Sho and like all the kids would hang out there and I feel like do they still have bowling

02:35:24 alleys I don't even know it feels like something that may have gone the the way of the the mid 2000s I don't care if no one bills anymore you're not going to ruin my good analogy okay well well my intent wasn't to ruin your analogy um okay tell us about bowling all the bowlers are going to come after me with with um bowling balls or something you're going to get blasted with all the stats on elevations don't hurt me sorry cool so if would one were to go bowling and they didn't want to put their ball

02:35:49 in the gutter yeah you could put these little bumpers in those Lanes all right and these little foam pads that go in the gutter that if your ball is going towards the gutter it hits those and bounces off and goes back in the lane right okay so in this entire conversation and this is actually true of a lot of the way people approach their fitness and health people are very concerned often times with optimizing meaning I want to make sure I don't go in the gutter I don't want to hit the walls so therefore I'm going to try to

02:36:18 improve the accuracy in which I throw the ball so I want to make sure that I'm throwing it down the center of the lane more often and I want to get my standard deviation Tighter and Tighter so that I don't get anywhere close to hitting the wall however what they're not realizing is if you do that the body will start shrinking the size of the lane because what it basically says is huh we haven't had a ball touch us in years we don't need to be this wide let's get smaller and smaller and smaller so it's not that

02:36:49 you actually are having a reduced ability to recover but you start becoming incredibly sensitive to that so your two strategies for enhancing recovery are to practice getting closer of throwing that ball down the middle lane or to widen to widen the alley and that's exactly what you're referring to and you absolutely should do that and so what happens is you don't have to be so precise with what you're doing because your ability to handle so many things is widen so if you're off now by four or five in to the right no problem

02:37:24 because you've just tripled the size of your alley that's exactly what you want to do so paying attention to two things number one is getting better at accuracy maybe staying really tight with your progressions um using nutrition and sleep to optimize your recovery and push your resilience is what we call this in fact there's actually a biological way to measure resilience we do that in all of our folks um this is scientifically validated stuff and didn't just make it up you can actually measure resilience and there's more and

02:37:53 more coming out on this but that's exactly what that term means so how well can you handle and bang things off the stress so when you see a reduction in say 10% of your HRV today for you that may make you feel terrible for me I might not feel anything because I'm well adapted to large fluctuations and therefore I'm okay the less and less you do that the more and more responsive you will be to those slight deviations so that is exactly the Target and that's kind of what I allude to when I say you got to understand what are we optimizing

02:38:26 for we optimizing for making sure I don't feel any different today are we optimizing to make sure when I do feel different I still am able to perform um so this is why you want to do things like maybe use some caffeine today and feel great but if I have to use it every day all I'm doing is shrinking my sensitivity there so now if I have to go a day without it I can't train at all right caffeine is the easy example because people understand how that whole system works but this is really true of everything else so yeah you need to

02:38:56 practice this and the way to do that is to give yourself more stress to continue to bring in the stress from nutrition from training from breath work um you mentioned earlier about

Focus the exact same thing right it's not just about getting better right now it's about training a system and you can clearly train that right um we will often say breath work is a practice that's exactly what we're talking about right so you're practicing getting better at these things you're practicing returning your focus you're practicing

02:39:28 recovering and quite literally physiologically you can upregulate whether we're talking enzymes whether we're talking about Regulators these will be upregulated so then the next time that insult comes in it's not as big as it's not as damaging so yeah absolutely you can and you should strive for that throughout all the episodes where we've been talking about exercise at the core of that is this word adaptations and I love that you mentioned that breath work can also create adaptations the way I'm

02:40:00 visualizing all of this now is that resistance training with weights machines body weight otherwise cardiovascular training running jogging sprinting jumping and so on thermal training exposure to heat exposure to cold in a dedicated way and deliberate respiration AKA breathing or breath work as a practice all of those can be viewed as ways to trigger adaptations and in the context of recovery the specific adaptations you're trying to engage are opposite to stress in fact with the exception of perhaps

02:40:41 deliberate cold exposure maybe deliberate heat exposure because if the sauna is really hot you can get the dorphin release which is kind of uncomfortable but but still in both those cases the rebound from that in other words when you get out you shower you go to bed the next morning you do have this kind of blist out feeling we know why that is that is the rebound to that uncomfortable situation so it seems it doesn't really matter whether or not you're using resistance you're doing cardiovascular training you're using

02:41:10 thermal approaches or you're using respiration based approaches all of these are really ways of both triggering adaptations and if applied properly to actually help you recover from the stress and create the the literal result that you're that you're trying to achieve for some people that might have been obvious but I think for many people including myself this set of conversations that we've been having over the series these episodes It's really the first time that I've ever thought about exercise in these

02:41:42 ways in any event it's just a reflection but it's one that at least for me um is tremendously useful because it has a lot of um Organizational logic to it uh which at least appeals to to my brain because the more that things have a logic the more for me that they become simplified and the more that the vast array of tools uh becomes uh becomes visible to me as you said earlier what is it let me make sure I get this right it's um concepts are few methods are many pretty close Okay how would you how remind us

02:42:11 how you state it methods are many concepts are few ah okay either way the directionality probably matter it doesn't matter no let's keep it right the the methods are many uh Concepts there a few um galpin's law I in science you're not allowed to name things after yourself um but you can name uh things after other people so uh it's a galpin's law because I'm definitely the one who created that idea so absolutely that was extreme and tremendous sarcasm just so we're Ultra clear regardless uh here we go G

02:42:39 galpin's Law there you go one thing that's in my head right now is we've thrown out a lot of options for folks and maybe what we can do is try to simplify a little bit so what I can kind of walk you through is how we uh measure recovery if you will and how often and some tools and what I would recommend people do is not use everything I said you want to pick one or two things per category that are most important to you that are at your cost uh that are at your availability that are interesting and important relevant to you and do

02:43:16 that uh the reason I kind of wanted to cover a a large number of things was was to give folks options but again I want to emphasize the point is to not measure all of them in fact you don't need to we um I've ran this before with professional athletes where we've taken blood urine every single day we've done performance measures uh vertical jumps on a force plate a whole bunch of things every day for years on end and what I can tell you is there is tremendous redundancy in physiology right Everything is Everything so you don't

02:43:46 need to do them and don't feel like you're missing out if you aren't doing them one or two metrics is probably fine I generally recommend one subjective measure this could be as simple as what's your mood how do you feel today great and one objective measure HRV resting heart rate anything else right so if you even literally just did that you'd probably have pretty good insight as to what you're doing so maybe in fact I I'll go more detail here um maybe I'll give you a couple of examples of things

02:44:19 to measure every day some things that you should measure maybe quarterly monthly and then maybe even semiannually and then you can maybe just pick a couple from each of these categories and have yourself a pretty good monitoring system for what to do and I'll include some that are um a little bit of Technology based and then others that are totally cost free and require nothing okay to start off I would recommend taking something like HRV every day or or most days um if you don't have a device like that you could

02:44:48 also use honestly the CO2 tolerance test and we've talked about that a number of times and we probably have plenty of resources to go find that uh but that doesn't require anything

it typically takes about a minute or so and you can do that under the same circumstances in which HRV in other words do it the same time every day have the same standardization stuff and that is actually been in our coaching experience um while admittedly there is no peer-reviewed research on this yet um just in our experience this tends to track

02:45:15 extremely closely with HRV and other metrics of recovery in fact we actually did do a uh a pilot trial in my lab and it uh it tracked decently well with both state and trade anxiety so uh it's a nice metric um not perfect but you you could take that so if you wanted you could do both um but again remember you're trying to capture systemic stress and so you're really just showing you're measuring one thing two ways so you don't necessarily have to have them both I will do both just because like I'm super interested in

02:45:48 small differences but globally they're going to tell you basically the same thing so those are two things we we use again basically daily year round or or close to it um if you want to go past that a little bit um you can look at you can use an actual a a pretty old commonly used survey called a daa d l d I forget the exact acronym but it is a fairly lengthy questionnaire and it accounts for things like how do you feel today how do you sleep um any stressors going on in your life how you've been

02:46:20 eating and it's this it's like fairly comprehensive lengthy survey um that came out I mean geez it's probably been around for 30 years or something it's it's nothing new and been used extensively uh I you would not want to do that every day if you wanted to take some subjective measures every day we typically stick with like I said mood um motivation something like that um you you could perform this do detesto something more like monthly or at the end of each training phase you know every couple of months and probably

02:46:49 worth looking at it's not going to tell you if you're in a bad spot today or tomorrow but you would pick that up with the HRV or suit to tolerance test it would though tell you information especially if you're working with another individual about major life changes and if anything it just facilitates that conversation right I noticed you reported X happening um let's let's talk about that and can I help Etc so another kind of sneaky helpful one is is simply body fi like I said um non-functional

02:47:19 overreaching and overtraining are associated with a number of things like energy um appetite suppression changes in in body weight or body composition so you can measure that um monthly or even really quarterly uh depending on what kind of athlete or individual you're working at or if you're trying to especially if you're not trying to lose weight or if you're trying to be at maintenance and that'll give you some insights as well so moving past that now actually we're going to move into the realm of things that we call Hidden

02:47:45 stressors so those those are all visible stressors um so hidden stressors the most common ones we've sort of mentioned U and I would probably do this um well you're going have to do these ones through serum so this is blood work cortisol like we talked about in testosterone and then of course testosterone to cortisol ratio and then the other ones I mentioned um you can do those quarterly it's not bad there are some blood markers that there's really no sense to do them that soon and there are other markers I mean in our system

02:48:13 our individuals are getting pretty extensive blood work saliva work urine and stool and there so there's plenty of those things you just do not need to measure you know every 10 weeks or so uh in this case you know cortisol as you know sort of changes rapidly um testosterone can change pretty quickly um but if you're really trying to notice a large Trend you know certainly quarterly or so is is an appropriate time frame um doing it every four or five weeks is probably unnecessary so you can save yourself some money and do

02:48:45 that um other stuff you can look at actually more like semiannually in um plasma like glutamine and glutamine to glutamate ratio and you can maybe save the why you want to look at those for another conversation but those are important um we always look at something from the oxidative stress thing so this could be something like tnf alpha or inter Lucan 6 something like that again we're looking at that in serum and we're looking at that you know like semiannually and then another sneaky actually one um that I love to look at

02:49:12 is uh the nutrifil the lymphocytolysis uh that number starts to get really high certainly like more than 9 to1 you got a pretty good Insight that something gnarly is going on with your immune system so um we will actually take action much lower than that number but that's like a nice cut off you'll see is like that's a very very high number so um those are some things you can use uh most folks have the ability hopefully to get some basic blood work done get a basic what's called a CBC and CMP um if

02:49:43 you have a great physician and you can get insurance to cover that and you just go on and ask for a CBC and CMP they'll what that means you can Google that and they'll order it you'll get all the information typically that I just described or close enough and you'll get some insights and then again you can just use uh that free service I mentioned earlier to check to see whether or not the changes are um just a matter of testing quality or actually physiologically relevant what you just described is an amazingly powerful array

02:50:10 of tools I'm hoping that you can also mention a few tools that are either lower cost truly low cost or zero cost that while they may not have the accuracy or um give the complete

picture that some of the biomarkers and other tools that you mentioned do that they can still provide reasonably reliable metrics that people can use in order to assess their level of recovery absolutely the CO₂ tolerance test would be the first one um and you can just take that metric anytime you'd like the other ones we've talked about so far are

02:50:46 things like your mood uh we haven't mentioned libido but that's another assessment that people also tend to have a pretty good grip on and they know what feels normal so when things go out of whack it tends to be a pretty good signal that people will recognize yeah and one note about that um so something that came up in an episode on uh on hormones both for male and female Health um that at some point will Air um which is that you know there's no objective measure for people in terms of libido

02:51:17 across the board meaning people people vary tremendously um age life circumstances um uh and on and on and so um this is one of those subjective measures that I think people need to uh have some sense of what their quote unquote Baseline really is and I'm guessing that the time to assess that might best be uh when initiating or Midway through a relatively low intensity training phase um maybe during the time of year in which all the other factors um that can influence libido are not um at their maximum so if you think

02:51:56 about you know light and dopamine and the relationship between those and the testosterone estrogen systems we know that libido uh testosterone estrogen men and women um tends to peak in the summer months so if that's your Baseline that you're comparing to I don't know that that's as reliable as um piing something like the the fall or the spring um and so anyway this again is very subjective but would just encourage people to uh recognize that there's no standard numbers for this no lookup table there's

02:52:25 no equivalent of the libido BMI LMI um no dis respect to the acronym that probably is LMI um so I think that it's just something to keep in mind as people um do comparisons or subjective comparisons is don't pick a comparison to an extreme try and pick a comparison to a average as you know it to be that actually sort of reminding me one issue that we have seen a lot lately is people if they're having libido issues or just even slightly noticing uh drop they just assume that then therefore means their

02:52:59 testosterone is crashing and those things are certainly connected but that is not necessarily the case and where that becomes a problem is then people then go uh on things like trt Etc with no true oversight and then all kinds of other problems so make sure that if you're going to take that step that you actually get testosterone measured and you're working with the quality ified person to guide you through that process don't just assume because you're having low energy or your libido is a little

02:53:24 bit down it could be simply training related it could be sleep related could be any number of things um so that's just like a little bit of a word of caution there two quick points along the lines of what you just said one interesting thing that I learned when researching our episode on testosterone and estrogen optimization this was an episode that we've done some time ago but is still available in our hberman lab.com all formats Etc is that many many people actually increase their libido and even their levels of

02:53:52 testosterone and estrogen as they progress from their 20s into their 40s if they take excellent care of themselves including the correct exercise adaptations correct body fat to lean um lean muscle uh ratios but of course it can go the other way too A lot of people can be training to achieve such low body fat stores that libido can suffer so it it you know the age depend uh age related declines in libido um are not necessarily um written into the script of life in fact there are some data points from a really interesting

02:54:24 paper I talk about in that um episode of uh individuals this was a study focused on males in their 80s and 90s who maintained total and free testosterone as high as uh individuals in their 20s but then when you look at the lifestyle factors of those people in their 80s and 90s they were doing a lot to create that that scenario the second point is one related to what you just said um which is very true which is people generally tend to assume that a drop in libido is related to a drop in testosterone um and then assume that

02:54:56 they need to increase their testosterone and in some cases that is true absolutely but it's also often the case that people who take estrogen or aromatase blockers that is enzyme um Inhibitors that prevent the conversion of testosterone to estrogen experience severe deficits in libido because of estrogen being too low so estrogen blockers are as much an issue here as um low testosterone then the final point is also one that um many people now men and women are um I think need to be aware of which is that dihydrotestosterone DHT is

02:55:30 among the more powerful androgens for um Power output physical power output but also for libido and DHT is strongly inhibited by certain things like turmeric so a lot of people who are taking high doses of turmeric uh can experience drops in libido so there and um who are taking um uh various compounds to prevent hair loss y things like finasteride so there's a whole catalog of things that can reduce libido that are not directly in the testosterone pathway it can be DHD related or estrogen related and this I

02:56:05 think points to the importance of yes take a subjective measure of your libido pay attention essentially be aware don't you know don't obsess but be be aware and try and figure out

what factors um are involved for you but don't immediately assume that it what's needed is more testosterone and often times um the opposite is the case yeah you yeah try to put on a lot of muscle with no estrogen good luck right and and indeed a lot of um athletes in particular uh you know competitive bodybuilders that

02:56:33 have that you know Saran Wrap thin skin if you get to know some of those people and you talk to them they can um look like the sort of comic book archetype of what um someone might might want to be I mean that's not what this discussion or these episodes have been about but often times they can have um serious libido issues I mentioned earlier and I will emphasize it once more you need to be very cautious when you're taking antioxidants anti-inflammatories cortisol reducers for all those reasons

02:57:05 right I didn't really sort of get in examples but you just nailed another fantastic reason of it um we do not give those things prophylactically ||| I strongly discourage people from just walking around taking supplementation of antioxidant um especially powerful ones for no reason if you have done some testing um and you have a good reason to do so I'm fine or if you're in a very specific say training phase or something like that cool um but if you're just walking around doing that you are often times

02:57:34 not always but you're often times causing problems that then you then try to solve by taking more of those anti-inflammatories I feel terrible low energy low libido blah blah blah blah I'm too inflamed Etc so yeah antioxidants in the form of food are fantastic almost no issue there is a good evidence actually there so don't worry about man I shouldn't eat High antioxidant-rich Foods you're going to be fine what we're talking about here is Pharmaceuticals and supplementation where you can take orders of magnitude

02:58:09 higher dosages very quickly than you could in the presence of food so that distinction is also very important antioxidant-rich foods are generally fine and that's cons consumed in totally absurd concentrations supplementations powders creams drugs Etc is where you can get into problem so yeah you want to be very careful of doing that unless you have a reason we don't do that unless uh we see a reason to do so in someone's markers yeah and herbal compounds despite the fact that their herbal can

02:58:35 be quite potent modulators of hormones um ashwagandha being uh an example uh two herbal compounds that we've talked a lot about on our podcast before and repeatedly uh including in that test off asteron optimization uh episode uh Tonga ali um and fogia grus um Tonga Ali is now taken by a large number of men and women um Tonga Ali and fedoa typically men I'm not sure that there are any good studies about the effects of fedoa in women those are herbal compounds that can have potent effects in increasing

02:59:11 testosterone and glutin ising hormone uh do they work yeah they work to varying degrees in in most everybody not certainly not in everybody um but they do work but they they work because they're potent they have effects so the idea that herbal compounds are not powerful um is wrong and it's important to remember that that can cut both ways hence my mention of this uh observation related to turmeric which is not to say that some people can't take turmeric and feel perfectly fine maintain or even

02:59:41 increase their libido that sure that can happen it's just that for people that are very DHT sensitive this tends to be an issue so so unfortunately for many of these compounds the only way to find out is really to try them or to just completely avoid them and decide you don't want to try them is fine too but there really aren't ways to predict who will respond who won't and who will be hyperresponders and um in that case it's a bit of a it's a little bit of a wild west I'm also sort of remembering what

03:00:12 the point of this conversation was supposed to be and maybe I'll I'll return back to that which were some cost free or low cost metrics um that was a very fun tangent but nonetheless uh another couple of ones you can do are uh grip strength testing so if you can buy a you know fairly cheap handgrip dynamometer uh on any number of places these are typically able to be purchased for 20 to \$40 or something like that range um you can actually just test that every day I've done that uh in a number of athletes for a decent amount of time

03:00:47 uh admittedly I don't do it anymore that's not because I disagree with it but because we just we're getting the information already and it was just too redundant but if that's the only option it is a great one to do I mentioned Also earlier how I actually like speed tests over strength tests as an earlier indication of overreaching and so because of that I like a vertical jump test um if you have access to a force plate that's great and then you can get uh more in-depth characteristics of the force velocity curve and acceleration

03:01:17 and things like that um used a lot in high performance situations if not simply looking at you know your performance and so you can kind of go back to one of our earlier episodes when I described coloring my fingertips with highlighters earlier in my life you could do the same thing and go out in your garage and every day jump up and touch uh that marker and see where you're at um so a system like that could be done you can also use tools like uh Force transducer and do a standard movement against say a vertical jump or

03:01:47 a high Pole or something like that and measure the velocity and just compare that day to day of a standard load right so you do it every single time with the same load um same similar

thing could be done with like a medicine ball throw um so you have the same ball you throw the same thing and just sort of where you're at today you want to do a little bit of warmup but not excessive here you want to kind of get an idea of where your Baseline is and you don't want to influence it by the veracity uh of the

03:02:12 warm up every single day because that alone can change it same thing with stretching uh acute static stretching directly influences power production so you don't want to go out there and one day do a 20- minute stretch before and then then the other day you didn't stretch at all because that alone will cause uh deviations in your performance so try to keep everything you can think of standardized and that'll give you a little bit better data remembering all of these values the biom markers the

03:02:39 performance stuff they have normal variations you just want to figure out first and foremost what those normal variations are for you so you have your normal number you have your standard deviation when you start getting outside of that standard deviation you start paying attention and so that's kind of like what we typically call that the gray Zone and so if is in the gray zone we're fine we're not adjusting but if it's outside of that whatever that is for you recognizing that the gray zone is smaller

03:03:05 for some folks and larger for others but what is normal for you and your situation and then you can make your decisions outside of that when you see numbers that are consistently or more than 3 to 5 days and in a row or close four the last 5 days four the last six something like that then you may have some cause for Action well that was an incredible description of the various tools and modes for recovery and I realized I jumped the gun a bit during our discussion about food and supplements but I like to think that it

03:03:39 serves as a nice uh precursor to the next episode which is going to be all about nutrition and supplementation if you're learning from and or enjoying this podcast please subscribe to our YouTube channel that's a terrific zero cost way to support us in addition please subscribe to the podcast on Spotify and apple and on both Spotify and apple you can leave us up to a five-star review if you have questions for us or comments or suggestions about topics you'd like us to cover or guests you'd like me to include on the hubman

03:04:05 Lab podcast please put those in the comment section on YouTube we do read all the comments please also check out the sponsors mentioned at the beginning and during today's episode that's the best way to support this podcast I'd also like to inform you about the hubman Lab podcast free newsletter it's called the neural network newsletter and each month the neural network newsletter is sent out and it contains summaries of podcast episodes specific protocols discussed on the hman Lab podcast all in

03:04:31 Fairly concise format and all completely zero cost you can sign up for the neural network newsletter by going to huberman lab.com go to the menu and click on newsletter you provide us your email we do not share it with anybody and as I mentioned before it's completely zero cost by going to hubman lab.com you can also go into the menu Tab and go to newsletter and see some example newsletters from months past thank you once again for joining me for today's discussion about fitness exercise and performance with Dr Andy Galpin and as

03:04:58 always thank you for your interest in science [Music]

00:00:00 [Music] welcome to the hubman lab guest Series where I and an expert guest discuss science and science-based tools for everyday life I'm Andrew huberman and I'm a professor of neurobiology and Ophthalmology at Stanford School of Medicine today's episode is the third in the sixth episode series on fitness exercise and performance today's episode is all about endurance and fat loss that is the specific protocols required to achieve the four different kinds of endurance and how to maximize fat loss

00:00:30 Dr Andy Galpin great to be back today we're going to talk about endurance and I'm very interested in this conversation because I like many other people strive to get a certain amount of cardiovascular work in each week maybe a longish jog maybe a swim ride the bike Etc but when I think about the word endurance the idea that almost immediately comes to mind is about doing something for a long period of time repeatedly but I have a feeling that there are other ways to trigger this adaptation that we call the endurance

00:01:03 adaptation so I'm excited to learn about that I'm also excited to learn about the fuel systems in the body that allow for endurance and other modes of repeated activity so in order to kick things off I'd love for you to frame the conversation by telling us what is endurance and are there indeed a large variety of ways to induce what we call this endurance adaptation sure the way I want to start actually here is is calling back to some of the things we talked about in our previous conversations which are really people

00:01:35 have exercise for three reasons number one you want to feel better number two you want to look a certain way and then number three you want to be able to do that for a long time right so you need the way that we say it in sports is look good feel good play good right so I want some sort of functionality to be able to perform a certain way whatever that is for you you want to be able to look a certain way that whatever that matters for you and then you want to be able to do that for a long time so when it comes

00:01:57 to endurance we have a bunch of misnomers here which is the same thing with the strength training and resistance exercise side where we wanted to dispel this myth that I lift weights only because I want to gain muscle or play a sport and I want to do cardio because I want to either lose fat or for long Health sake and just like we smashed that myth from the strength training side I want to smash it from the endurance training side there are so many other reasons that you want to perform endurance

00:02:25 training regardless of your goal right whether it is longevity whether it is performance or whether it is Aesthetics and so we're going to I want to cover all those reasons uh exactly what to do Protocols of course and why those things are working that way in general though the quick answer is really endurance comes down to two independent factors Factor number one is fatigue management and then Factor number two is fueling and that's all it really comes down to so all the different types of training

00:02:56 are going to reach a limitation which are either again your ability to deal with some sort of fatigue and that's generally a fatigue signal the other one is managing some sort of restriction of energy input and a lot of the spoiler here is a lot of the times people think it's a fueling issue and really it's a fatigue management issue or the opposite and to have a complete Health Spectrum regardless of whether you're a high performance athlete like I typically deal with or general public you need to

00:03:24 be able to do both manage fatigue as well as understand fuel storage so that's really what we're going to get into today fantastic I can't wait before we dive in I'm going to ask you what I often ask people who are expert in their respective fields which is is there any nonobvious tool or mechanism or tool end mechanism that can allow people to access better endurance you know when I think about training for endurance again I think about trying to run longer and longer each week or Swim further and further

00:03:58 and so on but I do wonder whether or not there are other forms of training that can amplify the endurance adaptation that I or most people perhaps don't think of as endurance sure the way I want to answer this is if we look back and think about how we've answered that question with power and strength uh and force production it is really about how much can you produce maximally once what you're asking now is how can I repeat that same quality of performance if that's the case endurance really comes down to your ability to

00:04:35 maintain proper mechanics that's going to like the biggest way we can increase your endurance exponentially very quickly is mechanical and this is starting with breathing and so we need to be breathing properly we need to have proper posture and positions and then we need to be moving well efficiency is going to Trump Force always for endurance the other of the equation it's

not that you can have a little bit of leaks in your mechanics and still squat well or jump high and be fine because you don't have to suffer

00:05:08 those consequences repeatedly right that's going to drain you over time so uh the quickest way to improve urance is to improve mechanics and the mechanical thing I would go after first is your breathing techniques your pattern your entire approach as well as your posture and then from there the third one would be your movement technique is it possible to describe the best way to breathe when doing endurance training or is it more complex than that and if it is far more complex than that then certainly we can get into it during

00:05:34 today's episode yeah it is both of those I will give you a quick answer though a lot of the times you can kind of Hit the cheat code which is nasal breathing there there's plenty of times when you don't want a nasal Brea or don't need you nasal breathe but just again as like a one tool that is a for a pretty General answer if you can do that a lot of the times that will fix breathing mechanics just by default and we can maybe talk about why that is later but that would be my sort of one sentence

00:06:00 bullet point answer immediately uh of how to get in the right positions the second one would be simply looking at your posture right so whether you're on a bike or you're uh doing a lift or you're running if you're literally uh hunched over and your ribs are touching your femur or getting closer and closer like uh tends to happen on a bike or an air assault thing for somebody I've seen recently this morning I was on the assault bike um doing a a Sprint um and I asked Andy Dr Galpin to uh critique my

00:06:31 form and anything else he wanted to critique so that I could improve and he did comment on my rather c-shaped posture correct um encourag me to uh be more upright which I should probably do now as well and he also queued me to the fact that during a one minute Sprint there is something that is quote unquote magic that happens right about the 42nd Mark yeah and I use that as a um as a milestone uh to look for and indeed something does happen at the 40 second into a one minute Sprint where all of a

00:06:58 sudden it it does seem to get much easier for reasons I don't understand maybe you can tell that but it certainly had nothing to do with my posture my posture needs Improvement thank you well yeah so um breathing mechanics and breathing strategies uh people tend to be over breathing early on and this is going to lead to problems later so having a more strategic breathing pattern uh and approach is again a very quick solution I know that we're going to dive very deep into the mechanisms of Energy and

00:07:28 Metabolism and endurance today but as long as we're having a discussion about these um brief sort of tidbits of how to improve endurance are there any other ways to improve endurance that are of relatively short time investment even if they require a lot of um energy sure the classic Paradigm you're going to find here is steady state long duration posed up against what a lot of folks will now call higher intensity interval training specifically and there's a lot of misconception here the quick answer is

00:08:01 you need to be doing both and there's probably a bunch of stuff in between that you should be practicing if you honestly want to maximize those three factors we talked about at the beginning you need to be training across this full spectrum just like I told you to train across the full spectrum of your lifting we want to be doing the same thing here so are there independent special factors that can happen with the shorter Tim length higher intensity stuff absolutely there's also magic that happens on the

00:08:25 other end of that Spectrum so it's very important that people don't just choose one side because what tends to happen is people either go with the oh I'm going to do 30 or 45 minutes of steady state stuff that's it or I'm going to do the opposite which I'm going to leave that stuff on the table not do it because I only want to do high intensity intervals because I can get it done in five minutes so there's Magic on both sides of the equation we want to get into all that but just to answer your question

00:08:50 directly there's a whole bunch of of things you can do um in under one minute um that are convenient to do and there's a a wonderful set of papers um out of a couple Laboratories in Canada that that championed this idea that's called exercise snacks so there's a bunch of there's a series of studies that have been done here that are really interesting and they've looked at a couple of things that are noteworthy one of them is a 20 second bout of all out work and this is actually done in workers in an office and so what they

00:09:17 had them do is run upstairs and I believe it was about 60 steps is is what it took them something along the order of 20 seconds exactly and they repeated that um about once every four hours so really it's you go to work you get you know put your coffee in your bag down whatever you run up a flight of stairs 20 seconds later then you go right back to work at lunch and before you go home you sort of repeat it there um and if you repeat that that's multiple times a week you're going to do that I think

00:09:42 they in one of the interventions it was three times a week for six weeks 18 total times you did that and what you'll see is um a noticeable Improvement and this is statistically significant improvements in cardiorespiratory Fitness specifically V2 Max as well as a number of cognitive benefits his work productivity Etc that can happen in as little as 20 seconds you don't have to go to

the gym you don't have to shower you don't have to do anything like that just find the stairs um run up and down

00:10:10 them a few times now you may have noticed um you actually sort of caught me yesterday I did that right here right I was just I we had a little bit of a break I was feeling an energy lull I ran up the stairs three or four times felt a lot better so that can actually also help they ran another study where they looked at that following a Jun giant high glycemic index meal and what they saw and they took insulin measures and and a whole bunch of um other biological markers Associated that you want to be

00:10:40 pay attention to with the high glycemic index meal and they looked at those immediately an Hour 3 hours 6 hours and sub post and it was very clear that same intervention was able to improve post plal glucose control insulin and a whole bunch of other factors um in addition to that so if you are the sort of type who's like wow I'm in an office all day maybe also had a giant high glycemic index meal not the best approach but a little bit of mitigation there can just be running up a flight of stairs or doing

00:11:09 something like that for as little as 20 seconds so there's a lot of magic and power and maximal exertion if one does not have access to a flight of stairs at work could they do jumping jacks absolutely I mean you could do anything you really wanted um it's not the mode of exercise that matters here it is simply the exertion um you just get up as as hard as you can you could do burpees you could do any number of things um you could Sprint down your road down the hallway back and forth um the mode is is just

00:11:42 U something that was easy for the scientist to control and X number of steps people could do it you're not going to fall hurt yourself things like that just to remind me it's once every four hours one minute of all 20 seconds oh 20 seconds excuse me uh 20 seconds of essentially all out exertion yep while remaining safe not going so fast up the stairs or doing jumping jacks so fastly not down the stairs up the stairs please um escalators don't count well I suppose they count if they're uh you know if if

00:12:13 you're moving uh if you're not remaining on the same steps um in fact in an airport recently I saw somebody walking against the the conveyor yeah while talking on the phone while waiting for their flight to take off and I thought it's genius right it looked a little awkward who cares yeah but it was uh I have looked awkward in every airport I've been in for the last 15 years for these exact reasons doing wild stuff like that yeah well nothing's more Awkward than not being able to walk to the end of the terminal simply because

00:12:41 one isn't familiar with walking that far carrying a couple of suitcases there you go yeah that's the the other fit test the suitcase carrier in the airport I love this so once every four hours 20 seconds so maybe once when arriving to work once 4 hours in and then four hours and most people are probably at work somewhere you eight plus or minus two hours now one thing I actually really want to make clear because your audience is so incredible um they tend to to be really excited about these protocols and

00:13:09 they follow them exactly it's written that's not exactly how science works so it doesn't necessarily have to be every four hours it doesn't have to be three times a day it doesn't have to be 20 seconds they literally built that protocol because it was they're trying to replicate a real life scenario maybe you're in an office building you're generally there for eight hours Let's see if you did one every sort of at um so if you want to do it four times a week great if you can do it only 10 seconds amazing like you're probably

00:13:34 going to get the same benefits those are not the details to pay attention to the detail to pay attention to is every so often multiple times a day try to get your heart rate up really quickly doesn't require sweating doesn't require anything else there's no warm-up associated with it um again you need a minute break in between meetings or whatever and you can Sprint up them I do this all the time in my house when you know have those days when you're on like seven straight hours of zooms Etc

00:13:59 you can get out of 20 seconds I run to my garage which is over there I hop on the airbike and I will just smash out 30 seconds as fast as I can and then walk right back in love it yeah I'm gonna start yeah just also you can just put one of those things which I do also just put one in your office and hop over right over there you know the whole entire thing now literally takes 23 seconds before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at

00:14:26 Stanford it is also separate from Dr Andy galpin's teaching and research rolls at Cal State Fullerton it is however part of our desire and effort to bring zero cost to Consumer information about science and science related tools to the general public in keeping with that theme we'd like to thank the sponsors of today's podcast our first sponsor is momentus momentus makes supplements of the absolute highest quality the hubman Lab podcast is proud to be partnering with momentus for several important

00:14:51 reasons first of all as I mentioned their supplements are of extremely high quality second of all their supplements are generally in single ingredient formulations if you're going to develop a supplementation protocol you're going to want to focus mainly on using single ingredient formulations with single ingredient formulations you can devise the most logical and effective and

costeffective supplementation regimen for your goals in addition moment to supplement ship internationally and this is of course important because we

00:15:17 realize that many of the hubman Lab podcast listeners reside outside the United States if you'd like to try the various supplements mentioned on the hubman Lab podcast in particular supplements for Hormone Health for Sleep optimization for focus as well as a number of other things including exercise recovery you can go to live momentus spelled ous so that's liv.com huberman today's episode is also brought To Us by levels levels is a program that lets you see how different foods and activities affect your health by giving

00:15:43 you real-time feedback on your blood glucose using a continuous glucose monitor many people are aware that their blood sugar that is their blood glucose level is critical for everything from Fat Loss to muscle gain to healthy cognition and indeed aging of the brain and body most people do not know however how different foods and different activities including exercise or different temperatured environments impact their blood glucose levels and yet blood glucose is exquisitely sensitive to all of those things I first

00:16:14 started using levels about a year ago as a way to understand how different foods exercise and timing of food relative to exercise and quality of sleep at night impact my blood glucose levels and I've learned a tremendous amount from using levels it's taught me when best to eat what best to eat when best to exercise how best to exercise and how to modulate my entire schedule from work to exercise and even my sleep so if you're interested in learning more about levels and trying a continuous glucose monitor

00:16:43 yourself go to levels. link huberman that's levels. link huberman today's episode is also brought To Us by element element is an electrolyte drink that contains the exact ratios of the electrolyt sodium magnesium and potassium to optimize cellular functioning for mental and physical performance most people realize that hydration is key we need to ingest enough fluids in order to feel our best and perform our best but what most people do not realize is that the proper functioning of our cells and nerve cells

00:17:11 neurons in particular requires that sodium magnesium and potassium be present in the correct ratios now of course people with prehypertension and hypertension need to be careful about their sodium intake but what a lot of people don't realize is that if you drink caffeine if you exercise and in particular if you're following a very Clean Diet that is not a lot of processed foods which of course is a good thing chances are you're not getting enough sodium potassium and magnesium to optimize mental and

00:17:39 physical performance element contains a science spack ratio of 1,000 milligrams that's 1 gram of sodium 200 Millig of potassium and 60 milligram of magnesium and no sugar if you'd like to try element you can go to drink element that's LM nt.com huberman to get a free element sample pack with your purchase again that's drink element lmnt / huberman to claim a free sample pack so tell me about endurance what is endurance how do I get more endurance and how does it work when we think about endurance I would like to open up the

00:18:11 conversation to include more things than people generally do when they hear the word endurance so if we just think about what you typically ask your body to do or would like to ask your body to do and we just walk through them it's going to be things like this number one I want to have energy throughout the day that's actually form of endurance great I don't want to have these lulls and fatigue and I want to feel fantastic as I move throughout my activities of daily living whatever those may be work

00:18:39 exercise enjoyment cogn paying attention focus all that stuff great that's one thing another thing you want to ask your body to do is I want to be able to repeat some small effort in a muscle group and not and feel great about that this is what we generally call muscular endurance so this is something like I want to be able to walk up those 10 flights a step and my quads aren't burning at the end of it right or it even gives me energy another thing you want to ask your body to do is to be able to perform a tremendous amount of

00:19:09 work for a longer period of time something in the realm of you know 20 to 80 seconds so this could be something like if you're surfing and you've got to paddle extremely hard for a minute to get on on top of a wave or you want to you got you're out riding your bike and you need to be able to get up a hill and it's a very Steep Hill these are going to take maximal efforts um for for some small amount of time and then you'll get back up there we tend to call that maximum Anor robic capacity so that the

00:19:34 max amount of work you can perform at a higher rate for some amount of seconds to like maybe a minute past that is your ability to repeat an effort kind of like that for something like 5 to 15 minutes and this is the example would be run a mile right some some interval like that which is a longer distance right um that is going to be your maximum aerobic capacity right and another thing you're going to want your body to do is what we call sustained position so this is you want to be able to sit in your chair at

00:20:05 work and have perfect posture for 20 30 40 minutes right you want to be able to stand in line at a grocery store for 15 minutes and not have a breakdown in posture so you want to be able to maintain position when you're riding your bike you're not collapsing you're doing any of these activities and you don't get hurt or lose efficiency simply because you couldn't sustain basic

positions all right whatever those shapes and positions need to be okay and then the last one is a a maximum distance so we want to be able

00:20:33 to go for a longer hike or have just a long day at Disneyland for whatever it needs to be and feel great at the end of it right so the goal with all of these things is not can you just do them but can you do them and then you feel good afterwards so we're back in a right position where they give you energy you feel good about it and it's not just something you had to do and you regretted and you felt awful so those are the factors I think about when someone says I want better endurance is I want to walk backwards and say okay

00:21:01 when you say endurance what do you mean and that's generally the things I've come across is if you can handle all of those things you're going to feel like you're in fantastic shape you're going to feel your recovery is going to be excellent and your physical performance in the gym or in any of the sporting activities you do will be enhanced given what you told us a little bit earlier that endurance really reflects fatigue and management and energy production how do each and both of those things relate

00:21:29 to endurance at a mechanistic level really what I'm asking is what is fatigue management and what is energy production in order to do that it's important that we understand all of those functional capacities that I just talked about they all have different points of failure okay so in order to then work backwards and say well how do I optimize my performance in all those categories we need to go through each one and figure out well where am I failing some of them are going to be failing because of fatigue management

00:21:57 and some of them will be failing because of energy production issues so if we walk through a little bit of how we make energy and how we handle fatigue then we're going to have a better understand of exactly what to do for each one of these categories if you feel like one of them in particular is uh worse for you or lagging behind or if in general you just want to improve all of them all right now I going to make a little bit of a 90 degree turn here I'm going to do it with strategy though I promise and I

00:22:22 want to ask you a very simple question how do you lose weight I was taught that the calories in calories out thermodynamics of energy utilization governs most everything that is if I'm ingesting less caloric energy than I burn then I'm going to lose weight and if I'm ingesting exactly as much as I burn I'll maintain weight and if I ingest more than I burn then I'll gain weight sure that is the approach you would take what I'm asking really is how are you actually physically losing the weight so my understanding is that we have

00:23:01 different fuel sources in the body glycogen which is stored in muscle and liver body fat which is sort in mainly white adipose tissue and which is subcutaneous and around our organs intrav visceral fat and that we can also use protein as a fuel and then as I recall there's also a phosphocreatine system and I think you're going to tell me that each of these systems is tapped into on different time scales and perhaps according to different levels of exertion and I'm certain that what I just said is not exhaustive but

00:23:38 hopefully it is most or entirely correct pretty correct what's that got to do with fat loss uh at some point uh body fat stores atos adipocytes fat cells are going to start liberating fat as a fuel source and the stimulus for that I'm assuming is going going to be that other fuel sources are either depleted or that the energy and metabolic systems of the body I don't want to say decide because they don't have their own Consciousness but are um are flip are signaling in a way that registers that uh body fat

00:24:16 would be the optimal fuel source given how long or int Andor intensely a given activity has been performed okay we have some stuff to clean up there but we're still not really answering the question how am I actually losing that body fat uh how is it actually leaving the body correct uh my understanding is that it leaves the body through respiration aha so now we have some interesting things to talk about how am I actually losing fat via respiration what the hell does that even mean how is something that occupied this

00:24:50 physical space on the side of me leaving my body through my mouth and there there's a very clear answer there right which I'm I'm sure you're queued up to when you take take a breath in you're generally breathing in oxygen O₂ there's some other things but we'll just stick to oxygen when you exhale you're breathing out CO₂ the difference between those two is that carbon molecule well one of the things that's important to understand here is all of your carbohydrates which is that word itself is a carbon that has been hydrated so it

00:25:19 is a carbon molecule attached to a water molecule it is a simple chain of carbons your fat molecules are also chains of carbon all of metabolism really in terms of energy production is simply trying to figure out a way to break those carbon bonds as a result we get energy from that we use that energy to create a molecule called ATP which is the central source of energy for any living being right that carbon is then floating around in free form which is bad news internally so we've got to figure out a

00:25:50 way to get that carbon out of our system so all of energy production all of fatigue management really comes down to this core issue of how are we handling car carbon and how are we moving it around the body and so what we do is we do this sneaky thing so another question I like to ask people is why do we breathe well for two reasons uh to bring oxygen into the system and

to offload carbon dioxide but the neural trigger for breathing is when carbon dioxide hits a threshold level in the set of neurons in the brain stem and elsewhere

00:26:24 uh activate the frenic nerve or the gasp reflex or a combination of things and we inhale or exhale right so a reduction of oxygen intake generally doesn't stimulate ventilation unless you're at altitude then that sort of changes right in general it's an elevation in CO₂ that's going to stimulate breathing off the only reason you bring in O₂ for the most part is to get rid of the CO₂ oxygen is not a fuel source it is not a way it works the same with fire by the way so you know you have to have oxygen

00:26:55 present for a fire to go and if you squelch oxygen the fire will go out right that's about half of um how those like fire extinguishers work but we think then that means oxygen is the fuel it is not the fuel it is something entirely different it is a necessary product that is necessary for the metabolism process to actually occur all right so we're kind of dancing around an idea here which is this carbon cycle of life so what happens in plants is they generally will breathe in the opposite

00:27:26 and breathe out the opposite of humans so a plant will breathe in CO₂ and exhale O₂ right this is why we have to have a certain amount of these things and algae and forests and trees and stuff to maintain this O₂ CO₂ balance in our atmosphere we do the opposite and so we have this wonderful circle of life we breathe in O₂ breathe out CO₂ they do the opposite well what happens is because carbohydrates are long chains of carbon and fats are as well generally when we think about fats by the way it's

00:27:54 important to understand that structure a little bit so if we think about triglycerides um is a three carbon backbone chain of glycerol so one two three and horizontally running off of each one of those are fatty acid chains right so we form this structure that looks like an e right like the letter e three in the back and then three chains coming off of it each of those chains are called fatty acids and each of those fatty acids are a length of carbon right a number of carbons strung together however many carbons are there

00:28:23 determines which type of fatty acid it is right so steric acid lonic acid like any different number of things it's also what determines whether or not is a monounsaturated or polyunsaturated is if um carbon requires a special thing called a double bond so if there's a double bond across every carbon of carbon then they're all fully saturated and you're great if there's any of them that are not double bonded in fact in example if there is one that doesn't have a double bond that is now called Mono unsaturated and if there are many

00:28:49 it is called polyunsaturated so there's pros and cons to all these things right in either case we're still talking long carbon chains so what a plant will bring in carbon and then it has this wonderful ability to use energy from the sun called photosynthesis and it can take those carbons that it inhales and use the energy from the Sun to form a bond now in our prior discussion when we were uh going over hypertrophy we talked about the energy was required to go through protein synthesis that's because

00:29:19 forming a new atom or a new bond between atoms often times takes energy in these cases it does the same thing happens here so if a plant does not have oxygen or does not have carbon dioxide in the air it has no fuel the basically think about it is that's what it eats it needs to get nitrogen from the ground in the soil it's like we need to get nitrogen from our protein but fuel-wise it needs to get carbon dioxide then it needs sun to give it energy so it it can actually form that Bond right that's where it's

00:29:47 getting its fuel from all right so if we think about um a classic uh plant produce the plant that produces either a starch or a fruit here's what happens it inhales that carbon and it starts packing it away now in a root vegetable what it does is it stores those things together and if we store that thing and we grow fruit at the bottom of it we tend to call those things starches all right it's going to then take the carbon that is packed away in its root and send it up the tree and it's going to actually do that by breaking it down

00:30:20 into a smaller form of carbohydrate that we tend to often call things like sucrose and glucose it'll ship that up the tree it'll go out to the leaves and it'll convert it into the fruit and it's going to eventually transform that stuff into smaller carbon things called fructose and if we think about the fruit or the sugar in fruit it's often in the form of fructose or sucrose or a combination and sometimes glucose so we have these smaller carbon six carbon chains generally in the form of glucose

00:30:49 that are being made from this larger storage of carbohydrates that we call um starch right so it's packed in together your body does the exact same thing so if it's a potato and it has a whole bunch of glucose packed away we call that starch if it's in your quadricep and we pack about a whole bunch of glucose Away We Now call it glycogen if it's in your blood as that six carbon chain we call it glucose if it's in the tree and in the fruit we call it fructose right those are different molecules but that's

00:31:27 effectively the same thing happen so the biology or the chemistry is almost identical it just runs in the reverse order and that's why again tubers and potatoes and stuff tend to be starches and fruits tend to be glucose fructose and sucrose so we have this wonderful Circle of Life the plants can survive on just breathing in the CO₂ and then getting the energy from the Sun we

don't have that ability at least to my knowledge to run through photosynthesis so the only way we can get carbon into our system is that actually ingest

00:31:59 carbon which means we have to eat the starch the fruit the animal some other form of stored carbon to get that into our system we then pack that away we put the carbohydrates as you mentioned earlier either in our liver our blood or in our muscles we put the fat generally in adipose tissue we'll put a little bit in muscle cells as intramuscular triglycerides and then the protein we use as structure right to do different things we don't like to use protein is material or fuel it's it's better use

00:32:30 this structure and what we have to do then is if all of a sudden we realize that storage is getting too much in our body in other words we're gaining too much weight we have to figure out how to get the carbons out of our body and that is metabolism right anytime we're trying to break a carbon bond that we can get energy to make ATP that's going to release the carbon out of our tissue into the blood we have to bring in oxygen to bind that carbon molecule to make CO₂ so we can exhale it and put it

00:32:59 back into the atmosphere that's a beautiful description of the circle of life and energy utilization in the human body I have to ask the question that I'm sure many people are wondering about which is if indeed we exhale these carbons and as it relates to Fat Loss that is the way that we lose fat if we're in a sub caloric state for instance has it ever been explored as to whether increasing the duration or intensity of exhales can accelerate fat loss I mean that's sort of The Logical extension of

00:33:34 what you described and here I'm actually interested uh equally in whether or not the answer is yes as well as whether it could be no because I could imagine if the answer is yes well then there's some interesting protocols to emerge from that but that if it's no it will reveal to us some important bottlenecks about metabolism and energy utilization you ever seen the those magicians who like show up and uh they can tell your mom's name or something like that before you because they can sort of lead you down a

00:34:08 path yeah I mean not to take us down a deep dive tangent but I once went to the Magic Castle in Los Angeles and I was one of the people called up front and a in an incredible magician named um I think his name was Azie mind or something uh I think that's right had me write my name on a card in a Sharpie pen I ripped up the card I ripped it up I put it in my pocket and at the end of the 10 or 15 minute bout of him doing a bunch of other tricks he asked me to look in my right shoe and under my foot

00:34:43 in my right shoe was that card intact yeah and it was no longer in my pocket and I swear in my life I wasn't a collaborator with him and it to this day it still gives me chills because it well I don't know how magic yeah right magic well the reason I say that is I've given that little Spiel that I just gave you that countless times in my classes and I would say 99% of the time as soon as I stop the very first question is so can I just like do a bunch of exhales and lose fat which is wonderful because I was really hoping

00:35:18 you would do that and you rolled right into my trap right you landed perfectly so I look like a like a magician over here I feel like I should look in my right shoe right now no I asked the question because it's the logical extension of what you laid out but I know biology to be um both uh diabolical and cryptic but also Exquisite in the way that things are arranged and you don't get something for nothing there are no free passes in physiology that's the saying no free passes um the answer to your question is

00:35:50 yes 100% yes in fact that is the only way to go about it you have two options you can ingest less carbon or you can expel more carbon people always say calories in calories out it's really carbon in carbon out that's that's what a calorie is Right calorie is the amount of energy we get per breaking a carbon Bond so it's really Less in Le more out less in is fairly obvious whether that comes in any form and by the way this is exactly why the percentage of your intake coming from fats or carbohydrates

00:36:20 such it doesn't really matter that much if you look at fat loss um clinical trials you guys may have covered this when Lane was in here I'm sure like this is something he talks about a lot it doesn't matter it's irrelevant because it's not about that there's nothing magic in those things they are different they have different physiological responses everything is different right no doubt but in general it's just simply about carbon intake turns out fat has a lot more carbons per mole than carbohydrates do so there's more

00:36:49 calories per mole in there so if you the physical amount of fat needs to come in as a smaller amount physical amount of carbohydrates needs to come in will come in as a larger amount but you can play any number of very high carb low fat what matters total calories right again it's not like the only thing that matters but you know what I'm saying some percentages in the way can go fat loss Works fantastic high fat low carbohydrate why why do all these things work because it's not about that it's about total intake of carbon total

00:37:20 XEL so absolutely can you lose fat by simply exhaling more in fact that is exactly what you did this morning when I hopped on the aird bike for when you did anything right the question is can you think of a scenario in which you could have a bunch of increased rates of exhalation that helps in Fat Loss sure I can think of a lot of things that will stimulate increased rates

of inhal exhalation one thing could be simply going right and so the question is like can I literally do some breath protocols

00:37:52 where I force exhale and lose fat and the answer is yes but what happened what happens if you do hyperventilation training well my lab studies cyclic hyperventilation is one of our many uh deliberate protocols and one of the most prominent things that one observes is that levels of adrenaline increase very quickly extremely quickly people feel jittery anxious stressed and unless they are consciously trying to Anchor their thinking about what that means and the benefits that to persisting typically

00:38:26 they abort the cyclic hyperventilation protocol really quickly within seconds right you will feel tingling sweating all kinds of things you're hyperventilating right and we could we could talk in nauseum about how that changes everything from adrenaline to focus a whole bunch of things so unfortunately a strategy of sitting around just exhaling more than you inhale technically helps you lose more fat but it's not going to last very long so then the question is well how do I get into a situation or a scenario in

00:38:54 which I can increase my rate of expiration when where I'm not going to pass out and I'm not going and altering hypocapnia and hypercapnia issues any idea of a situation in which you would have an enhanced rate of exporation without worrying about passing out sure I steady state exercise or not steady state exercise lifting weights intervals moderate training repeated any of these things they all work equally for fat loss because all they're doing is increasing respiration rate they're saying increase demand for energy

00:39:28 increased exhalation that's the trick here and when you equate these things to that they have equal success in fat loss it doesn't matter theoretically where you're getting it from and so when we get into this idea of well what are the best training strategies for fat loss it doesn't matter which one of these tactics you pick as long as you maintain consistent adherence over time because of this exact fact it doesn't matter matter if you're burning quote unquote fat in the exercise session or if you're burning carbohydrates in the

00:40:04 exercise session it is totally irrelevant to your net fat loss over time okay now there's some significant misconceptions there about what I just talked and I I would love to come back and walk through that in more detail but that's the main take home message here it won't matter what's coming in and it won't matter what's coming out because in either case it is the same rate of oxygen in n CO₂ out that's the key metric and hopefully this helps a lot of people have some relief because they're like man you're so tied up on what is

00:40:36 the exact protocol for training for optimizing fat loss what's the exact nutritional intervention I need for fat loss and then you wonder why all these different diets can work effectively and wonder why all these different training protocols you know surely you know somebody who lost a bunch of weight and the only thing they did is they just started running there was no Advanced protoc they just started running they ran 5 miles every day that works and then tons of people who tried that and like didn't lose anything

00:41:01 and lots of people who went to I went to cardio kit Boxing class lost weight oh I just started doing intervals on my why why mysteriously do all these things work there there you have something has some spidey sense have to has to be going off in your brain we're like there has to be something linking these things and what's linking it is simply carbon exchange so put yourself in a position in which you are exhaling more than you and inhaling without passing out the other problem is if you were to

00:41:29 Simply do a breathing protocol while the rate of exhalation would go up after that you would correct and go in the opposite direction so that's the problem is your net carbon output over the course of the day is not going to change unless you increase the demand for energy and that's how you get into that negative State along these lines of exhaling carbons uh as the route for fat loss makes me wonder whether or not increasing lung capacity is possible I'm guessing the answer is yes and whether

00:42:00 or not increasing lung capacity is a good goal and route to enhancing fat loss essentially what I'm asking is if you can offload more CO₂ okay carbons per exhale are you a more efficient fat loss machine it's a wonderful thought and the answer would be no not something need to worry about because if you were to Exhale more carbon than actually needed now we're in a state of inefficiency you're burning way more energy than needed to do your activity the heart has a metric called cardiac output this is in science we

00:42:40 abbreviate this as Q for some odd reasons it's either Co or q and cardiac output is heart rate multiplied by stroke volume so it's how many beads per minute you're having as well as how much blood's coming out of it so cardiac output is actually very specific to energy needs if you try to work around that it's just going to adjust itself so what I mean by this is if you were able to increase your stroke volume the amount of blood coming out per pump you would automatically adjust to reduce your

00:43:06 heart rate so that you keep cardiac output exact to energetic demands so you're sort of pushing one end of the of the spectrum but your body will pull the other one back to keep you at that exact same neutral level so um if you look at if you think about like cardiovascular adaptations to endurance training any type of endurance training a common thing people will understand is

resting heart rate and so what that number is is just how many beats per minute you're having when you're sitting here doing

00:43:33 nothing a very positive adaptation is a lowering of that resting rate over time um as general numbers what you will hear is people will say things like a normal resting heart rate is between 60 to 80 beats per minute and you know if any of the things I've talked about um with the individuals I work with I don't work with anybody with disease just to clarify that I don't do anything with disease management treatment anything it's always about people who are in a good spot who want to optimize or get to

00:44:02 the next level whether this is professional athletes trying to to Peak for physical performance or uh the folks in our rapid Health optimization program that feel good again it's not disease stuff and they want to feel incredible one of the metrics we're going to pay attention to is this resting heart rate so here's what happens as you improve your endurance your resting heart rate will go down if I see somebody over 70 beats per minute um unless something's going on you're not physically fit regardless

00:44:30 of whether or not that is quote unquote within the normative values I want to see everybody sub 60 beats per minute or close right and that is not a difficult thing to really get to for most people so if you train a lot regardless of how you train intervals steady state doesn't matter that resting heart rate will come down but since energy demands at rest haven't really changed cardiac output stays the same so what happens is stroke volume goes up so literally like we trained your quadriceps on the leg

00:45:02 exension machine to get stronger so you can produce more Force per contraction the heart will do the exact same thing and so as you're able to get more of the blood out of your heart per pump the heart realizes I don't need to pump as often so that's the compensatory adaptation which is saying hey look I don't need to beat 60 times a minute I now need to beat 55 times a minute because I'm getting the same amount of Blood Out per pump chill and this is why your wrestling heart rate goes down your resting stroke

00:45:31 volume goes up but your cardiac output is identical so that's not a good metric of Fitness it's going to stay the same cardiac output will only adjust per energetic changes all right uh energy requirements in the acute moment right how much do I need go which is going to be determined by ventilation right how much air am I bringing in and putting out that's going to determine cardiac output and that's going to determine where we're at if you were to do like a submaximal exercise test when you were

00:45:58 unfit to when you're fit or when you're fit to where you're super fit at submax you're going to see the same thing cardiac output will be identical and you're like damn nothing happened what you're not realizing is your heart rate at that same workload is now lower and that's efficiency because your stroke volume is higher where it gets people tripped up is at Max because you may not see much of a change at Max um because you won't really you don't really see an increase in maximum heart rate with Fitness

00:46:25 that's not a thing right so maximum heart rate is not a good proxy for fit or unfit or anything like that um stroke volume will get limited eventually by filling capacity of your heart it has to have so much time to fill up with blood before it can contract again and squeeze the blood out and when you have a heart rate of 200 beats per minute that just doesn't leave much time to fill and so it won't really push you past that so um don't worry about trying to increase your maximum heart rate that's not

00:46:50 necessarily a good thing and it won't really change but your cardiac output will because stroke volume will be higher but that doesn't necessarily mean that I should avoid training that gets me up toward maximum heart rate correct oh you should absolutely do it right that's what that was my assumption I'd like to take a brief break and acknowledge our sponsor athletic greens athletic greens is a vitamin mineral probiotic and adaptogen drink designed to help you meet all of your foundational nutritional needs I've been

00:47:15 taking athletic greens daily since 2012 so I'm delighted that they're a sponsor of this podcast the reason I started taking athletic greens and the reason I still take athletic greens once or twice a day is that it helps me meet all of my foundational nutritional needs that is it covers my vitamins my minerals and the probiotics are especially important to me athletic greens also contains adaptogens which are critical for recovering from stress from exercise from work or just general life if you'd

00:47:41 like to try athletic greens you can go to athleticgreens.com huberman to claim a special offer they'll give you five free travel packs and they'll give you a year supply of vitamin D3 K2 again if you'd like to try athletic greens go to athleticgreens.com huberman to claim the special offer getting back to energy production and Metabolism so we've got these different modes of moving energy making and breaking energy Bonds in the body moving energy into different tissues and out of different tissues and

00:48:09 indeed out of the body through exhalation how do each of these different modes of energy utilization relate to different modes of movement and exercise yeah in my mind I'm starting to draw a bridge between okay when I walk for 60 minutes you know if I'm talking I'm breathing a bit more maybe I'm burning a little more fat after all speech is is a modified exhale um and amazing if

I'm sprinting I'm breathing differently and if I'm um you know doing a 30 minute moderate quote unquote moderate jog I'm

00:48:46 breathing differently so you've beautifully illustrated this bridge between energy production and utilization and carbon dioxide offload through exhalation what are some of the specifics about energy utilization according to different modes of exercise and if we could better Define modes of exercise or types of exercise that trigger specific adaptations I think this is where the the bridge will move from being a a mere line to a real structure yeah absolutely I want to lay one more foundational piece and then

00:49:18 it's going to be much easier to understand the limitations I put on some of these training protocols as well as the lack of limitations okay so it's really really important um the way I want to start this is we have this this Foundation now of of carbon and and basic energy production that's not to say there's no difference there is and that difference is important but maybe we can answer the question from earlier which is actually something you asked me this morning when we were exercising you're like training fasted right does

00:49:51 training fasted enhance fat loss and the logic is sound if I don't have any fuel then I should be burning more fat therefore I should be losing more fat it's sound it's not true is this great idea it's one of these classic things in science and exercise phys physiology where like sounds good turns out it's not it's actually a pretty gross misunderstanding of metabolism so it's not to pick on that topic I don't really care about that topic but it is a it's a common question it also gives me an opportunity

00:50:23 to just tell you more about metabolism so here's what happen you are breathing in O₂ and breathing out CO₂ however the ratio to that is what we call the either reer respiratory exchange ratio or RQ respiratory quotient and I'm not going to differentiate those two they're not the same thing but we're going to skip past that for now as you begin to increase exorcise intensity the percentage of O₂ to CO₂ rises in the favor of CO₂ so you start breathing out way more CO₂ than you are breathing in O₂ right and so if we were

00:50:54 to look at that number you know what's the relationship it goes up so at rest most people have a a of a value that we would typically call something like 0.6 okay and that's again the relationship between O₂ and CO₂ maybe 0.7 if you were to go for a walk that increases slightly because you're now expiring CO₂ at a higher rate so now you've moved up to say 08 or something like that one of the ways that we Mark somebody of achieving an actual V₂ Max on a test is if that value exceeds 1.1 one now any of you who are paying

00:51:30 attention are thinking well wait a minute how the hell can a ratio between two things ever get past one well that's because you're getting into a place where you're actually offloading more CO₂ than is actually necessary and this is what actually causes and explains a thing that people like to call Epoch which is excess exercise post oxygen consumption this is another way to think about it the only reason you're breathing is to bring in oxygen an offload CO₂ right if I'm no longer exercising why am

00:52:00 I still breathing in other words once you stop the demand or the need for for energy you should stop ventilating but you don't right that's because in the case of low intensity exercise the second you stop you're right back down to resing ventilation no problem because you were able to match the need for energy with the offload of waste one to one during that exercise when you start creeping up the intensity you can't do that so you have to basically start stealing a little bit of fuel here so even though

00:52:35 you're done exercising you're still ventilating because you have to pay that back and pay that back by that I specifically mean you have to bring in oxygen because you have a whole bunch of waste that's been accumulating in your tissue that you've got to deal with and I I'll walk you through what that waste is it's a particular molecule that a lot of people have heard of but grossly misunderstand so you got to be able to handle that so the reason that you sit there and go and continue to ventilate is because

00:53:01 you're now trying to pay back that excess post exercise oxygen debt that's that oxygen debt we're specifically talking about all right so that being said as we start cruising up that RQ starts going up up up up up up and if we get to one you're 1.0 you're you're in a like you're hurting you're you're in a pretty good spot all right I like that you're hurting you're in a pretty good spot yeah there a a window into Dr Andy galpin's mind now you really want to be a subject in his uh his laboratory

00:53:29 studies sure masochist swarm to Andy's lab absolutely all right so the idea that I will lose more fat by being in an exercise situation that is burning more fat it seems to make sense but it's a massive failure to understand the metabolism it's the exact same explanation to why exercising fasted doesn't matter so the exercising fasted issue under normal circumstances is irrelevant because you have plenty of fuel in the system even when you haven't eaten breakfast that morning now if you're talking like extended fasting

00:54:07 over multiple days this is a different scenario if muscle glycogen liver glycogen and blood glucose are at sufficient levels then you absolutely have enough energy to perform almost any type of exercise that most people are doing you know maybe if you're Rob and you're at Mile 20 today it's a different story but the vast majority of us have PL fuel sitting around so we're not going to

burn more into fat just because we didn't eat breakfast that morning so that just doesn't make energetic sense we have a lot of backup supplies you're

00:54:35 never out the trick here is this is there's a there's a concept here we call crossover concept so as we are starting to move up exercise intensity we start burning a higher percentage of our fuel from carbohydrates and a lower percentage of our fuel coming from fat I'm sleeping that's the highest percentage of your fuel that will be coming from fat of any activity you could ever do so if the theory that I'm going to stay at a lower intensity to burn more fat was true the optimal fat burning strategy would been be to

00:55:09 sleep like that doesn't make sense of course it doesn't so why would then going at a slightly elevated rate somehow all of a sudden magically make you lose fat it doesn't actually make sense when you think about it that way you're like oh yeah there's no way so it's a percentage trick it's a difference between absolute and relative this is what this confusion is so yes as you start doing lower intensity exercise whether you're faster or not it's irrelevant but lower intensity exercise a greater percentage of your fuel is

00:55:37 coming from fat however your total fuel expenditure is very low so that whole total carbon balance is not really being shifted much as you start exercising in a very high intensity you actually start getting a higher percentage of your fuel from carbohydrate and a lower percentage from fat in fact at rest about the highest you can get in most people is about 60% of your fuel from fat as you're sleeping you might be 70% but you'll never be in a position ever no matter what sort of thing you've heard on the internet you'll never be in

00:56:15 a situation where fat is your only fuel source the highest I probably ever seen is like 70% um you should probably be at about that's that's a kind of a good number to think um honestly but people will who understand a little bit about metab metabolism to be dangerous but not enough we will throw out these terms like fat adapted and fat adapted is a real thing but is a massive misunderstanding often times right it is this idea thinking like I can get into a spot where I'm maximizing fat burning

00:56:44 maximizing fat burning and maximizing fat for exercise and maximizing fat loss over time are not the same thing at all right that's the confusion so if you enhance fat oxidation in an exercise that does not enhance fat loss per se right so this is a lot of the confusion that's happening right so as we start moving up we can never get in a position where we're using fat only as a fuel again at best you're at 70% fat 30% carbohydrate for a lot of reasons we probably just don't have time to get into today however the opposite is

00:57:19 possible when you get into true high-intensity exercise you'll be basically 100% carbohydrate and 0% fat right that is very possible that in fact is 1.0 that's what R 1.1 is actually because your ventilation got so high you actually exceeded that number even though you're at 100% carbohydrate this is what people came up with the idea then it's like Well I don't want to burn carbs I want to lose fat so my response to that is always like okay great so makes sense burning fat losing fat burning carbs is losing what then

00:57:49 like you think your liver shrunk like like wait a minute what did you lose then where did it come from it's all coming as carbon don't worry about where it came from for your fuel it just has to come out as carbon right there are differences in exercise efficiency for performance with our professional athletes of course but if the only goal here is Fat Loss it doesn't matter where you get it from the last Bridge we have to connect here is like well wait a minute if I only burned carbohydrate how did I actually lose

00:58:21 that fat there was there was that love handle sitting on the side of me how did that come out of me if I never burn that for my fuel what you're failing to understand is there's a balance game that happens here so if you were to do a bunch of high-intensity exercise training and you burned only muscle glycogen and blood glucose and maybe even you did it for so long you burned some liver glycogen the body understands that it has expelled a lot of energy from that side of the equation it's going to do a

00:58:49 couple of things now it's very difficult to go through this fancy situation where you convert carbohydrates into fat and back and forth like that's actually like fairly hard what it's easier to do with something you said earlier is actually just bias energetics to a different fuel source so in that scenario where you're down really low in your carbohydrate carbohydrate stores any carbohydrates you bring in are going to go to storage and since your net energy expenditure is something that your body regulates a lot

00:59:20 any fat that you then bring in is going to be utilized as a fuel source because it knows it doesn't need it anymore that is an access so that's how you actually use fat as a fuel because you've burned down carbohydrate storages as I'm hearing this uh a couple of things come to mind first of all thank you for that in incredibly important description of what is otherwise a very confusing landscape for most people one of the key points I took away and I just want to say from the outset this is not exhaustive by any

00:59:53 stretch is that burning fat F does not equal losing fat from the body correct and then burning fat has to be divided into burning of body fat stores and we need to distinguish that from burning of dietary fat that is brought in correct oftentimes people don't disambiguate those correct right and I'm also understanding that reducing one's body carbohydrate stores muscle glycogen

liver glycogen Etc occurs during high-intensity exercise yep as well as other ways but that is one very efficient way to tap into those stores

01:00:30 which makes me wonder again this is one of these things that does it lead to a protocol makes me wonder whether or not doing high-intensity let's say weight training for 45 to 60 Minutes 75 minutes of strength training power training hypertrophy training which we've covered in an episode about those topics and then doing some steady state cardiovascular exercise is there any benefit to that arrangement that would quote unquote enhance body fat loss from the body to be very specific now because unlike the

01:01:07 idea that training fasted would shift the bias towards fat loss which it doesn't you've told us under those conditions muscle glycogen and maybe even liver glycogen is going to be depleted put simply can I enhance body fat loss by doing some cardio after a b of weight training if you equate for total energy expenditure it won't matter now you did bring up a very important point that I want to clarify if you look at the exercise modalities that we laid out in our previous uh conversations we talked

01:01:39 about nine different adaptations one was skill and then speed power strength hypertrophy muscular endurance Anor robic capacity aerobic capacity and long duration endurance now speed power and skill development have almost no benefit for fat loss because remember those are low weight a lot of rest and low volume they're not really really going to be helpful you can make a little bit of a case for strength a little bit but the total energy expenditure for strength training even if it's an hour if it's

01:02:15 truly strength training it's fairly low because the repetitions are in the one to three range that's exactly it's not enough for total work so if you're trying to develop a protocol that sort of optimizes fat loss what you want to do you were close in my opinion is to a combination of something in the hypertrophy slm muscular endurance strength training realm okay so um six to 30 repetitions something like that of resistance training great deplete muscle glycogen maybe even a bit of liver glycogen maybe a little bit

01:02:46 depending on if you're doing it for a long time but probably not a noticeable amount okay so an hour of of uh hypertrophy type training if if you're training hard with low rests and you really did an hour you would for sure get there but most people don't the reason why I crave large bowls of oatmeal and rice after I do weight training I want to replenish muscle glycogen totally right um then you maybe do a little bit of very high intensity maximum heart rate well over V2 Max uh hard as you can for 20 30 45 60 seconds

01:03:17 something like that with some recovery a lot of recovery and repeated and that's going to do a great job of deplete muscle glycogen right if you do that long enough you'll get the liver but again most people don't cuz it's really really hard to go that hard so liver is sort of last Last Resort yeah basic mechanics here which we'll which we'll actually get into as our like third segment here is um energy production comes from the local electrici muscle first and foremost from phosphocreatine and carbohydrate stores right and again

01:03:48 and we store in a muscle we call it glycogen right that's just your first sign of light up defense if you need glucose outside of that you're going to start pulling it from the blood but one of the things your body regulates a handful of things over almost everything blood pH blood glucose blood pressure and electrolyte concentrations like it really does not want to mess with those things at all it will change almost anything else in the body to keep those things standardized right you generally

01:04:12 because you need all those things for your brain to work and your brain will stop working right if you lose blood pressure it won't go up there pH changes you can't run metabolism electrolytes change you can't think and glucose is a primary fuel source for the brain it's going to be a problem right so if that number starts to come down because you're grabbing glucose out of the blood your liver is going to then kick in it's going to break down its glycogen to put glucose into the blood to keep the blood

01:04:35 number the level in fact one of the things you'll see is blood glucose concentrations rise during exercise they don't fall they in fact they rise as an anticipatory state if you train a lot your blood glucose will start going up before you start moving it knows it's coming right so you you can play that game you can rob Peter to pay Paul for a long time until your liver runs out and that's what actually is a Bonk in terms of like long duration endurance stuff you're talking many many miles

01:05:00 several hours typically we say oh it's got to be over 2 hours um before your liver starts to become a real problem or it has to be tremendously intense because of those reasons you have to burn through just a lot of energy before your liver starts to get into a problem you can continue to train when your muscle glycogen levels are low in fact um people say glycogen depletion of muscle but it's it's generally misnomer and you are going to have tremendous signals of fatigue when that gets lower than 75% so people think that

01:05:28 like their muscles are getting heavy you you're probably still 75% full um a lot of folks will quit around the 50% the highest I've ever seen is like 95% true depletion and that's in extremely high level cross country skiers and like they're deltoid gets very very low some very talented Runners will get fairly low in their quads but the vast majority of folks by the time you're 50%

depleted you're going to quit it's going to be really really challenging um so you're never really going to get that low it's

01:05:55 like a bit of a protective mechanism right but when your liver gets low you're going to be shut down and that's the case of if you've ever been to like a marathon and you've seen people run like 25 and a half miles and then they just like Bonk they go into like baby deer walking stance and then they collapse and you're like how are you mentally weak like you ran 26 miles and you can't run the last point it ain't mentally weak it is if your liver is done it's going to stop you because there's no more backup reserves muscle

01:06:19 you can get away with you can push through it liver will not let you go any farther I find this fascinating because it makes me wonder whether or not the liver being depleted sends a neural signal to the brain or the brain must register some signal like I would like to be alive tomorrow thank you whatever is happening right now um stopping is going to be safer than continuing yeah and so that stop signal um is one that I think a lot of people including myself are are intrigued by because we

01:06:50 always think that it's uh related to willpower but the brain needs to preserve itself and the master computer I mean there are ways to go into kind of automaton type um you know not thinking just doing type uh Behavior you have override switches right and you can play those cards and you can get better at learning and be less sensitive to that switch that's exactly what happened when you first start training right you start to realize like oh my gosh I'm super tired then you realize really

01:07:15 quick like oh I'm I'm totally fine here and this is like the P pick pick your person who's made sayings like this but it's like you're really only 10% depleted or 30% % or 40% or some we're all operating at 40% of what we could do of course any of those things are true because it is like a little bit of an override um you've just gotten very sensitive to being a small percentage depleted and you've learned okay I'm tired and there is a long way to go past that but once you get past that and you flip that override switch a

01:07:44 lot um you just you're going to break quickly because you you basically learn to ignore that signal and problems can happen really quickly after that and that's even experienced endurance athletes if you hit that level it's like you're going to be hitting the concrete next and that's you know potentially a problem I want to make sure I understand a concept that you referred to earlier correctly because I have a feeling that I don't and that's this issue of how the body accesses body fat stores MH when in

01:08:18 a sub caloric State and I'm doing mainly glycogen burning exercise yeah what I heard you say and please correct me where I'm undoubtedly wrong what I heard you say was that okay I go into the gym and I start lifting weights I'm burning muscle glycogen mostly local to the muscles that I'm using and then I start pulling glycogen from the bloodstream maybe there's some body fat stores that are mobilized probably not dipping into my liver glycogen okay I complete the workout Maybe I even hop on the airdine bike and

01:08:57 do a little Sprint I go for a jog maybe um I eat immediately afterward maybe I don't eat for a few hours afterwards but across the day I ingest fewer calories than I burn is it the case that body fat is mobilized in order to replace the glycogen that my sub caloric intake was insufficient to provide in other words because I didn't eat enough to fill the glycogen stores am I using body fat converted into glycogen to fill those stores right and if so is that a case where I'm no longer exhaling carbons in order to burn

01:09:42 body fat but rather I'm repurposing body fat into muscle have I turned fat into muscle in that case yeah I'm I'm really glad um you asked this because I did a very poor job on that last Point talking about earlier um I'm realizing playing back in my head because that's so many really good questions you cannot turn fat into muscle can you turn muscle into fat no I'm so glad you said that because when I was in college yeah our I don't want to out that person the physiology teacher seemed to think still at that

01:10:15 point that one could um lift weights get muscular but then it would eventually turn into body fat that that myth has I think largely been dispelled I heard that so many times uh as a kid I heard it so many times in college I heard it so I heard it so many times in our uh undergraduate students from other faculty and such so um no like they are not the same structures they are very different um let let me take a shout at answering this better you were really really close so yeah if you were

01:10:47 to do that type of exercise where you've burned a lot of muscle glycogen how is it I'm losing stored fat right that's really the crux of the question and it doesn't even actually matter if you then went ahead and ingested extra uh carbohydrates or fat post exercise that's not really thing you hang on a couple key things number one this is all under the assumption that total caloric intake is still low right you have below total need below total need right okay I also want to flag calories in calories out is not the only thing

01:11:20 that matters this is a very complex thing calories in is incredibly complicated calories out is even more complicated okay so we just maybe another series we can spend on that alone so don't go nuts about that you have to be hypocaloric one way or the other if you burn a bunch of muscle glycogen and you are hyper caloric you're still going to add fat if you burn a

bunch of muscular glycogen and you're hypochloric you're going to lose fat right think about it this way you are in a negative calorie

01:11:52 state where are those calories going to come from are you going to reduce your muscle glycogen storages permanently no no are you g to reduce your glycogen storage in your liver no you want to reduce blood glucose no no way right so where is that extra energy coming from it's coming from your stored fat it is your backup Reserve Energy System um the way that I want to flag this here is people tend to think about it as like carbohydrates versus fat that's not it's more like a chain more like a bicycle

01:12:23 where there's a front gear and a back gear you turn one gear it turns the other one these are complimentary systems they are not and or systems right you're you're turning one and when we go through carbohydrate metabolism maybe here in a second you'll understand why you have to have an anaerobic and an aerobic component to that there is absolutely no way to complete carbohydrate metabolism without oxygen that has to happen the only way to engage in fat metabolism is aerobic and oxygen there's no anaerobic component to

01:12:52 it so there's a fundamental difference there so the your carbohydrates are meant to be incredibly flexible it is the primary fuel source for a reason your fat is not meant to be flexible it is meant to be unlimited that's the basic point so you want flexibility over here and then unlimited capacity over there now I'm safeguarded against any energetic need okay I need to run up a hill for safety cool carbohydrates are there I need to then run for 17 hours cool fat is there we want both of these systems um you

01:13:25 want to be able ble to have great energy throughout the day you want a slow drip coming from fat you don't want up and down up and down feel great up and down awesome you want to be able to think very quickly and get hyperfocused boom carbohydrates ramp right up right get it into the brain get thinking better get thinking clearly fast so we want all these not just for exercise purposes for but for activities of daily living we want an optimal system here and when people use the terms like fat adapted

01:13:50 they're generally hijacking that and thinking M it used to be a thing we said all the time and like all of my undergraduate classes for years and that idea of metabolic flexibility is using optimal fuel sources and optimal types not maximizing fat usage they the people have co-opted that term of metabolic flexibility to being like Oh yeah yeah therefore learn how to maximize fat burning that's not what that term means that term means maximizing your ability to use whatever fuel is optimal in that

01:14:16 time now I'll Grant you most people aren't fantastic at using fat as a fuel source relative to the other direction but nonetheless the the gold standard here should be maximizing both all right finally answering your question if I were to to burn a bunch of muscle glycogen how am I losing that fat well the fuel you're ingesting in that hypocaloric state is going to say hey look we have a lot of muscle glycogen we have to replenish so any carbohydrate that comes in needs to be biased towards

01:14:48 storage it's got to go into those tissue any fat that comes in or doesn't even come in but any fat that we're using using for fuel needs to be utilized for activity and that's where the caloric expenditure from fat comes in so you're basically saying your general physiology the energy for that starts coming from fat and the energy that's coming in from carbohydrate needs to be simply stored and so what you see is your respiratory quotient changes right the re is going is going off and so in the exercise moment it shot way up for

01:15:22 carbohydrates and shot way down for fat as the compensatory response it goes the other direction because your body is saying we are low on carbohydrates don't use them for fuel unless we absolutely have to right so use them for storage get our fuel from the fat side of the equation and so what you're generally going to say is like oh I'm burning more fat just sitting around after things like that and that's not even taking into the equation the epoch part which is like it's it's not actually as large

01:15:55 as people think it is it's fairly small but it is it adds up sort of over time so um does that explain a little bit better about how you lose fat when you actually only burn carbs for exercise yeah you explained it beautifully you talked about Epoch the post exercise oxygen consumption yeah not being that significant in terms of energy utilization even though today we're talking about endurance and different forms of endurance I do have to ask whether or not people consider the elevation in basal metabolism that

01:16:28 occurs when there's more muscle around because muscle is such a metabolically demanding tissue um you know if is there a straightforward is equation you know if one adds one pound of lean muscle tissue to their body even if it's distributed across multiple muscle groups does that equate to uh a caloric need of X number of calories per day Y and is that because the muscle protein synthesis needs of that muscle or its glycogen storage needs or both if you don't have enough muscle you start to have problems with fat loss it's it's

01:17:05 difficult challenge if you have enough muscle uh and you're just trying to get extremely large if if your ffmi is 24 and you're 15% body fat adding more muscle is not really going to play a lot in the equation and here's why muscle is more metabolically active at rest than fat but fat is not inert so fat is still going to burn a small number of calories muscle burns more but it's not

nearly what people think it is I'm a muscle guy I'm a muscle physiologist I would love to get people to have more

01:17:34 muscle for any excuse I can it's not honest to say that though um you're talking about when I was in undergraduate we would say numbers like 50 kcals per day per pound is what you can look at right so if you put on a pound of muscle spread across the body your basal metabolic rate would go up by around 50 calories um per day I think that number is grossly exact exaggerated it's probably a tenth of that 6 to 10 calories maybe um it's it's hard to know exactly what that number is but the more recent estimates are something like

01:18:07 that so now on one hand you could say oh my gosh that is not even meaningful the other hand you could say that's super meaningful it just depends on time domain you want to put that out right so if you were to put on five pounds of muscle and your basal metabolic rate went up 30 or 40 calories a day well over the course of a thousand days like that adds up so you could slice this any way you want um now maybe that number is somewhere in between I don't really know it's not a field I pay that

01:18:32 much attention to candidly because it's it's not a metric kind of like Epoch um where it's like we used to really harp on it and now it's sort of like well maybe we exaggerated that like honestly just a bit but to me it doesn't change the equation much because if you don't have enough muscle as I describe there are other consequences that are going to make fat loss hard and so you need to have sufficient muscle if the additional caloric expenditure is the carrot great if it's something else I don't really care um

01:19:03 there's just enough evidence that you need to have it or I should say there's enough evidence that it will really help you in your path um maybe a few calories here there is not really the thing especially if you understand a normal food item anything you pick is going to be probably a couple of hundred calories one bad food Choice a day will outkick almost any amount of coverage you got on a adding muscle mass to you so like you're you're really stepping over a dollar to pick up a dime if you're worried about how many calories

01:19:34 you're getting from adding muscle um fat loss is going to be about regulating that carbon intake above and beyond anything else I'd like to take a brief break to acknowledge our sponsor insid tracker inside tracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate

01:20:00 and long-term health and well-being can only be analyzed from a quality blood test one issue with a lot of blood tests and DNA tests out there however is that you get information back about various levels of lipids and hormones and metabolic factors Etc but you don't know what to do with that information inside tracker makes knowing what to do with all that information exceedingly easy they have a personalized platform that lets you see what your specific numbers are of course but then also what sorts

01:20:24 of Behavioral do and don'ts what sorts of nutritional changes what sorts of supplementation would allow you to bring those levels into the ranges that are optimal for you if you'd like to try insid tracker you can visit insid tracker.com huberman to get 20% off any of insid tracker's plans again that's insid tracker.com huberman to get 20% off so I've heard about this concept of metabolic flexibility mentioned a few times frankly you're the first person who's ever explained it to me in a clear and concise way how do I know if I am

01:20:55 metabolically flexible and how do I increase my metabolic flexibility sure there's no specific standard which is actually a good thing right and so if you have a level of specificity that you want or need metabolically then you don't actually want to be in this Middle Ground an example would be if you are a performing in a type of exercise or an athlete who performs in a sport that is Gally dominated you don't want to be optimally metabolically flexible you don't want to be super quote unquote fat

01:21:31 adapted you want to be biased towards the energy you're going to use the same could be true for the other end of the spectrum so in those particular cases it's not optimal to be equally effective because there are no free passes in physiology right your energy producing systems will upregulate or down regulate accordingly so you will actually limit your ability to say maximum utilize carbohydrate as a fuel if you're trying to upregulate your ability to use fat as a fuel and so this is like there's a saturation Point

01:22:03 outside of that Spectrum most people who just say hey like I want to feel great throughout the day to be able to do a bunch of different things how do you know a couple things there's a lot of biological markers you can take um there's also just some some practical takes now none of these markers by themselves are any sign what you want to do is probably a couple of them and then say okay this is maybe a clue so again it's really important to emphasize not a single one of these tests that I'm about to walk you through

01:22:30 automatically means you can't use fat as of fuel or the other case which is maybe you're poor at using carbohydrate as a fuel so disclaimers aside um we we'll get into a couple of them so should we think about these as informative and useful but not diagnostic exactly uh what we call this data inspired or data LED and not data driven great okay cool so number one you want

to think about just overall functionality do you have a reasonable regulation of your energy throughout the day now many things could be going into

01:23:02 this which is why these are not specific Diagnostics but um as a basic measure we talked about blood glucose levels um you know a lot of people will say again you want that to be something like between 80 and 90 um milligrams per deciliter is a blood glucose level and and you can go look at the the cut off points for what determines to be pre-diabetic and type two diabetic as Etc um what I can actually recommend um this is there's a little bit of science here actually that I'll walk you through

01:23:30 but a lot of this is my personal preference um I generally want people to be at 85 or lower and that's because of a couple of things number one um there's actually some papers that showed any uh every single point increase above 85 increases your likelihood of developing type 2 diabetes by about 6% okay great so technically while maybe 90 or 95 or even up to 100 or you know in the quote unquote normative values that's one clue again it's not definitive by itself doesn't mean anything um you need to really pay

01:24:05 attention to what increasing by 6% actually means but it's a data point where I'm looking at if I actually then see symptomology and we run you through maybe some questionnaires ask how you're feeling throughout the day and we see uncontrolled energy bout so you're a lot of energy then you get really really tired and swings okay another data point all right and we may patch a few of these things together that may give me some Clues um that being said again this a lot of this rhetoric is used to then scare people off of

01:24:35 carbohydrates and that is I want to be as clear as possible that is not not truly um the only thing people should care about right it can be a thing it can also be unrelated there are reasons you could have blood glucose concentrations at this level or energy swings that are unrelated to carbohydrate ingestion at all all right so one test you can run in addition to that if you're going to get blood glucose measured you can look at some markers we talked about earlier which are as and ALT um we talked about

01:25:05 um how you can kind of look at that a to alt ratio before you can actually do the inverse which is look at alt and a um the kind of normative value there you're going to look at is like 08 I actually like to see it lower than that uh and that alone is has been actually associated with blood glucose disregulation and so if you see multiple of these signs again we're looking for patterns and patterns and patterns in both in our case biomarkers symptomology and performance and now you're if if all

01:25:33 three of those things are lining up you may have an issue so performance- wise a couple of little tests you can run um ideally you have some sort of standard workout you do and hopefully it's pretty objective so in other words like uh I run the same 15minute Loop every morning for my cardio okay great how long does it take you to run that Loop like you could pick whatever distance doesn't really matter um what's your heart rate during that thing and then what's your perceived exertion now you

01:26:01 should be able to do that fasted with very little drop in performance okay if you can do that then that tells me you're fairly good at using fat as a fuel source if however the one day you go to do your standard workout and you feel awful fasting that may be another clue that perhaps you're not very good at dialing in um that system if your recovery afterwards uh in terms of heart rate recovery is very long it may be another clue that you have a poor utilization of fat as a fuel source the inverse can also be true so

01:26:37 if I give you something in the neighborhood of like 50 or so grams of carbohydrate and 30 minutes later your face is falling off the table that's a good sign that you're in the opposite you're actually very very very poor utilizing carbohydrate as a fuel and the reason I bring that up is um that is equally a problem we send we hear people a lot make comments um like man I have to stay away from carbs I crash really hard if I do them that has what that actually means is you're very poor at utilizing carbohydrates as fuel

01:27:08 you're getting a your sensitivity is way off we should be able to have carbohydrate at a reasonable dosage 50 grams and not fall asleep 30 minutes later or or half to run to caffeine so um that is a sign in our opinion this is again now just my practical brain telling you is um that's a sign of of dysfunction um we we should be able to have plenty of carbohydrates through the day if we choose to if we want to for any reason um now of course if you were to throw 150 or 200 grams of carbohydrate in your belly you're

01:27:40 probably going to take a little bit of an energy hit after that but we should be able to have a reasonable dosage and not you know have to fall asleep afterwards what is one way that people can enhance their utilization of carbohydrates uh for exercise the reason I ask is I think I fall into that category y um I do consume some complex carbohydrates and fruit post resistance training MH and that tends to be when I'm hungriest for them but typically unless I'm I've just done some resistance training I keep most of my

01:28:14 daytime meals relatively low carbohydrate and then in the evening I prefer slightly less protein and more carbohydrate because it has this effect of um sedating me a little bit yeah and I sleep well and I know this runs against what everyone was taught uh which is to not eat carbohydrates late in the day but I like it because then I tend to wake up in the morning with at least

as far as I can tell my glycogen stores not necessarily topped off but but certainly filled y um and I'm able to train fasted in the morning and my

01:28:46 favorite pre-workout is uh consists of water and caffeine and electrolytes and maybe some supplementation as well but um I love training fasted so there's actually a number of things um one little sneaky thing you threw in there is actually the use of caffeine so that's another sign if if you have to have caffeine to do your fasted training that's generally another sign you're not very good at using fuel so I use caffeine prior to resistance training workouts generally I don't need it for any kind of cardiovascular training yeah

01:29:17 and when I say that it doesn't mean it's bad it's just like another clue that's like okay you should be able to do this without having to have caffeine to execute it now using caffeine to get a better result is is sort of different as an ergogenic aid um we actually use a lot of high carbohydrate meals at the end of the day a lot of the times for our athletes who are cutting weight or trying to reduce weight so it is a fantastic way to handle a lot of things and that idea that if you eat carbs late

01:29:44 at night uh that'll increase fast like that all is so old and so well destroyed scientifically that that's not a concern um either so much data showing in fact that there's so much data on like eating timing is is U generally poorly understood about when you can eat and what you can't eat eating in the morning um versus eating at night like a lot of what we've heard there is talking and maybe we just save that for sort of another day because we're going to get really far down there SP we can di into

01:30:15 it but um yes I think our plan is to cover that in an episode on nutrition um okay which is in this series the uh the only thing that I would add to it is you when you hear about ingesting carbohydrate late at night I should just say that uh at least in my case I'm eating the majority of my carbohydrate unless I trained resistance trained early in the day in which case I I post resistance training um in the last meal of the day but for me that's not really late at night that last meal is somewhere between 6:30 and 7:30 p.m. so

01:30:46 it's three or so hours or something like that go sleep around 10 10:30 or so so it's not you know midnight uh bowls of pasta I'm that too but um but typically it's not so I think that um people will be very interested myself included in how meal timing relates to all of this but um yeah let's so how do you improve fat utilization how do you improve carbohydrate utilization let's Hammer both out really quickly um enhancing fat uh utilization is as simple as doing a little bit of work in a either pre fat

01:31:22 ingested state so anytime you ingest a nutrient prior to training you're going to bias towards that nutrient right which is almost what we were talking about earlier so if you want to guarantee you burn more fat eat more fat prior to a workout now you're not going to lose fat but what you're what you're effectively signaling is we have an overabundance of this fuel preferentially Target this F fuel now the downside is that may actually hinder your performance um that's typically only a concern for people at a very high

01:31:53 level um fat is a slower fuel source so if you're relying more upon that your top end is going to come down a little bit and so you wouldn't want to use that strategy prior to race if it is a carbohydrate dependent race right and in fact we actually see long-term adaptations that would suggest that so the enzymes responsible for carbohydrate metabolism will downregulate and so you get worse at that so not a great strategy there um carbohydrate would be the opposite right so if you have carbohydrate prior

01:32:21 to exercise you're going to bias more towards that so a handful of things you can do if your total caloric intake is um simply managed that's going to take care of a lot of these problems a an appropriate eating strategy so the types of food the combinations of food um all those things are going to make your post carbohydrate ingestion Bonk a lot of those things can go away so there's a little bit of physiology that has to be um corrected for so it's a little bit in one hand you can go very deep here right

01:32:55 so the real answer of how we would do this is if we see a scenario like that we're going to do a whole set of analyses we're going to go full Labs right probably extensive blood panel urine saliva stool even and we're going to figure out where is that glucose disregulation coming from so a lot of people think like oh it's a metabolism issue it might be it also might just be a flag that something else is happening in the body so we're going to actually work backwards a lot to try to figure out exactly why that's occurring it may

01:33:22 be as simple as oh you're eating a lot of your carbohydrates without any fiber or protein and we know that that's important because those will actually blunt the GL the glycemic index like the rise in blood glucose so it could be a simple thing of just like oh your combination of food is doing it it's not the total amount um it may be something again more endogenous to the actual system uh it could be um a horrid issue it could be a breathing issue there could be a number of things so the way to get better at it

01:33:50 is to Simply train it and specificity is King here so if you want to get better at um managing your blood glucose throughout the day so that you're not feeling those things it could be a fuel issue but it could be a number of other things and it's just hard to go into all of them with within our time constraint um so the Practical tool that I would say here is if you want to get better at

managing energy throughout the day make sure that number one your protein is stabilized making sure number two you're

01:34:18 ingesting your food in the right combinations ideally with some Fiber and or some protein or both that alone will help stabilize a lot of the problems um then you need to train at high intensity you want to get better at using carbohydrates of fuel train at higher intensity and have carbohydrates right before the workout um we'll do that a lot if um uh if if we see folks who are I I kind of walked you through the test of identifying if you're not very good at using fat as a fuel the test for not

01:34:46 being good at using carbohydrate is the fuel is both that eating test I talked about as well as performance if you're a very very slow starter it's just like really hard to get going that generally indicates you might be in a situation when you're not very good at using carbohydrates as fuel so we're going to practice that we're going to have a pre carbohydrate pre-exercise carbohydrate meal and then we're going to do higher intensity stuff not to the point of making you sick and digestive

01:35:11 issues all that stuff but we want to get better at using carbohydrates as a fuel faster if you want to get better at doing the opposite then you do that opposite stratter either again using fat prior to the workout knowing your Peak performance is going to go down a little bit but you're you're investing in adaptation right so it's not about that workout it's about what's going to happen six 8 10 weeks from now investment is where you want to think about it or you could bring in some fasted training and so I want to really

01:35:38 make sure I clarify when we were talking about it earlier I'm not at all against fasted training it's not it works it's just isn't required for fat loss it isn't required for fat adaptation it is a great option though if you want um what I was hoping to do with that conversation and maybe I didn't articulate that well is to not restrict people but is to open you up and like you say you have a lot of options if you like to do fasted cardio amazing it is great if you hate it you don't have to you can reach the same performance goals

01:36:10 the same physique goals without ever doing it if you love long duration steady state stuff it is great if you hate it there are other options higher intensity stuff again if we're just talking about fat loss so I hope now that that's a little clearer in terms of the same thing with nutrition if you like higher carb great if you like lower car these are all great you have options and you don't have to fret so much over oh my gosh I have to do this thing a certain way and I absolutely hate it you don't have to

01:36:38 worry about it hit those Concepts and you'll be fine a few minutes ago you mentioned that if we ingest a given macronutrient fat then the body will preferentially use that fuel source you ingest carbohydrate we'll use that fuel source is it always the case that the body uses the ingested macronutrient prior to using glycogen I have to imagine it's using both I mean if I were to have some carbohydrate before um doing any kind of training the muscles still burn glycogen right or do they have some way to register the amount of

01:37:16 circulating carbohydrate that would allow or available carbohydrate in the form of food stuffs uh that would allow them to not tap into their own muscle fiber stores of glycogen all right so the way that we derive energy for exercise or basic maintenance a little bit about cellular physiology so you've got a couple of organel and structures that we need to pay attention to the first one is the nucleus that's hold you DNA the second one is the mitochondria and then everything outside of that you've got all these other organel that

01:37:45 do a bunch of things like ribosomes for protein synthesis etc etc all right now when you want to produce energy for exercise anytime you hear the word anaerobic you automatically understand we are meaning without oxygen all right great that all happens in the cytoplasm the cytoplasm is that space that is not the mitochondria not the nucleus so it's the space in between everything else this is like jellylike substance that sounds there so anaerobic metabolism happens there every single aerobic metabolic process happens in the

01:38:23 mitoch all right why is that important if I go to create cellular energy and I need it the fastest possible I'm going to go for phosphor creatin because it is stored directly in the cytoplasm the stoichiometry is one to one there which means for every mole of phosph creatin I burn I can create one ATP it's one: one it is incredibly fast but it is very limited because think about it how much of that could I possibly store in the small size of the cell that's it if I need energy past that point now I'll start using

01:38:55 muscle glycogen because that is also stored in the cytoplasm so it is right there the stoichiometry is not one to one it's a little bit higher probably like four to one so for every molecule of glycogen you burn you're going to get something like four is some small number of ATP out of that which is great but again you're running into a storage problem how much can I possibly store inside a muscle cell it is very very fast much more effective than phosphor but so there if I then want to metabolize any form of

01:39:27 fat or if I want to complete the metabolism of carbohydrates I have to start transferring into the mitochondria now I start getting whole hosts of ATP if you were to fully run through this thing which I'll talk about in a second um called the TCA cycle or KB cycle you'll get now something like 28 or 30 or 35 kind of depending ATP per so the energetic output is much higher okay

so here's exactly what happens and I'm going to walk you through this in the form of carbohydrate and then I'll come backwards and go through um fat so

01:40:03 remember carbohydrate it is one carbon molecule that has been hydrated so it is one to one so the actual um chemistry here it is C H₂O one carbon 2 H₁ glucose is a six carbon chain so the chemistry here is C₆H₁₂O₆ six carbons six Waters very simple that's a carbohydrate all right so you can imagine if you're watching on the video here you you'll see my fingers go nuts I'll try to make sure I explain it to you all just listening in an easy fashion so you've got this chain of six carbons is in front of you and the very

01:40:42 first step to metabolism is you snap that thing in half right so you break it into two separate three carbon chains all right now in doing that you got a little bit of energy because you broke that one Bond but not a tremendous amount this is called glycolysis so Lis being the split you know gly being you split glycogen up got a little bit of energy of that all right you form this three car carbon chain called pyruvate or pyruvic acid okay there's differences there but don't don't kill me General

01:41:12 audience friends all right I gotta gotta give this communicate this to everybody so you got a little bit of that now you can't do much past that besides rip one more carbon off of each of those three carbon chains so I've got two three carbon chains I got to be careful how I do this with my finger so I don't flip you off here in a second but I burn one more off of each I get a little bit of energy and now that little two carbon chain I have two two carbon chains those are called acetyl COA all right amazing I

01:41:40 have now completed anaerobic glycolysis I've got really nothing left I can do here I made a little bit of ATP now wait a minute I have now freed two carbons because remember I started with six and I split them apart but I didn't I had two three carbon chains I burned one each I've got two free floating carbons I have to now do something with them my body will not let me go through that part that last process unless I've got a plan for that free Carbon because I can't break it in half amazing here's what's going to

01:42:12 happen if I have those three carbon molecules and I don't have anywhere I can put that carbon you're not going to go through that process it's going to stop it you're going to start building up pyruvate now at the same time you're breaking ATP for fuel that's called ATP hydrolysis right you have water that comes in you have an adenosine and three phosphates that's why it's called ATP adenosine triphosphate 1 2 3 you break one of those phosphates off there you go there's your energy so now you have a

01:42:46 free floating inorganic phosphate and an adenosine D phosphate so two over there amazing that actually results because you use water for it results in a free floating hydrogen ion okay just have to trust me hydrogen H₂O any idea what a free floating hydrogen is um it's G to that's acid yeah say I was going to say it's going to increase acidity that's what acid for anyone that's ever measured pH what you're really measuring is the the amount of hydrogen potential hydrogen that's what PH is Right 100% there's two

01:43:21 definitions of pH but you get it that's one of the two so is this are you going to tell me this is related to the the burn we're going to get close right so I've got a bunch of free floating um you got the phosphates which are actually problem too probably more of a problem Than People realize and that hydrogen what are you going to do with that hydrogen well one thing you can do is actually ship it over to pyruvate and bond it there we have a special name for that little molecule when you have

01:43:48 pyruvate and you have hydrogen attached to it do you know what it's called Uh hydrogen peroxide lactate lactic acid this is that whole system right again I'm skipping some steps making a little bit of mistakes here intentionally folks just to make this assumed so what happens when you start running a bunch of anaerobic glycolysis you start seeing massive rises in lactate cool not lactic acid right right that's why we see associations between a lot of lactate and a lot of fatigue but the lactate is

01:44:24 actually not causing the fatigue the lactate is actually sparing you from having a bunch of free floating mhm acid it's also can be then used directly back in the muscle because as soon as you bring in enough oxygen and you can take that hydrogen back off of it you've now turned it right back into pyruvate and you can run it through this whole cycle as fuel that I'm about to do you can actually actually ship it out of the exercising muscle and ship it into a non-exercising muscle and then go backwards and make

01:44:50 glucose what actually liberates hydrogen from from lactate you like chemically yeah so what what liberates uh what well what are the stimuli that can take hydrogen off the pyruvate oh yeah and and then in other words to reduce lactate and free up that hydrogen oxygen availability so in fact one of the major places that you ship hydrogen to or one of the major places that you ship lactate to is your heart because it's what we call like the ultimate slouch fiber and it has a ton of freely available mitochondria which have

01:45:23 a ton of access to oxygen so it can actually then go to it form water the H₂O can be used to form water and now we have a place to store the hydrogen got it right cool so as a result of anaerobic glycolysis we have made a little bit of ATP we've created a lot of waste and we don't have anywhere to go with these end products so when you do anything of a higher intensity and it says

I need energy fast you're going to go to this system first right right past ATP because it is the fastest place to get energy but you're

01:45:59 not going to get much of it and you got to deal with the waste products boom right back to the beginning of our conversation endurance is about two things energy production and waste management and we're right we fatigue buffering this is it right how well can you handle the elevations in hydrogen right drop in PH and how and then what are you going to do with these products if you want to fully metabolize a carbohydrate you then have to take some do something with those pyruvates or those acdal coas

01:46:28 what you're going to do if oxygen is available you will take those things and ship them into the mitochondria they have to go through some cell walls and some other things like that but they're going to get inside there once they're in there that two carbon acetyl COA runs through this entire cycle that we call the KB cycle that's this really interesting place that's where uh B6 and nmn people are like that's where that whole stuff starts to kick in all your B vitamins basically run that entire circle um and

01:46:56 you're going to start off the top you have a bunch of fun stuff going on but as a part of that Circle you're going to pull off some some of the hydrogen ions you're going to send these to What's called the electron transport chain that's where you're going to get a ton of ATP out of and as a result about halfway through the turn you're going to pull off one carbon and about halfway through the other almost the other way through the Finish you're going to pull off the second carbon so you're going to

01:47:17 take the second acet COA run that entire thing same through as well and so what we did is we started off a six carbon glucose chain we split it in half we called those pyruvate made a little bit of energy because we broke that one Bond of those two carbons that are in the middle cool those two three carbon molecules we pulled one carbon off of each we brought in sorry we moved those into the mitochondria we brought one off we took a breath brought in some oxygen bonded that bre took out two CO₂ exhales

01:47:45 we ran the Asal COA through the crb cycle one two carbons per turn coming out of CO₂ so we had six carbons total when we started and we exited with zero carbons now we have fully metabolized a molecule of carbohydrate that required an Anor robic start and an aerobic finish if you don't have a lot of mitochondria large mitochondria and high functioning mitochondria you're going to limit your Anor robic performance because you're going to get you're going to run that door full very very quickly you can't go past it because hydrogen

01:48:22 will build up way too fast and one of the things that we know is both temperature and pH run enzyme function so they're going to stop you won't even be able to run through in fact that ATP hydras phase even if I gave you a whole infinite supply of ATP if I put enough acid in there it would stop working because the ATPase enzyme needed to split won't be able to run in a highly acidic environment or a hot environment yeah at some point perhaps today perhaps in a future discussion but still not too far

01:48:52 from now we could talk about the role of temperature uh in the in pyruvate from in terms of its regulation of muscle contraction but I want to make sure I understand something correctly you mention these these uh two parallel fuel systems right one is essentially anaerobic right and the other is aerobic you said that if we can't pull enough um if we can't break enough bonds then we limit our aerobic capacity correct I would have thought given that uh the mitochondria are the site for essentially for aerobic metabolism yeah

01:49:30 that we would be limiting our aerobic capacity as well um perhaps you could just clarify for me how these two things are divided or is there not a clean division is it not an either or No in fact again I think it's better to think of these things rather as two separate parallel things as one big cycle they're one gear turning the next being compromised in one will compromise the other that I should say reminds me of what you said earlier which is this the bicycle gear um analogy that works uh great so if you if you short circuit one

01:50:01 basically the the chain can't move that's yeah fantastic okay so um so indeed they they are running in parallel but they are um interdependent yeah well they're actually not even running in parallel because they're actually funneling to the same end point right which is like if you're going to come from the aerobic glycolysis route or you're going to come from the fat route which I'll talk about in a second they're both going to be limited in the mitochondria so when that thing's full it doesn't matter you can't run either

01:50:29 system right so is more of like a again if you're running the bike gears it doesn't really matter if the back one's larger or smaller because if either one is limited you're toast because they're running on the same system you can you can you can sneak a little bit here and there but but not much you also really nicely highlighted how lactate this thing that we think of as a a limiting factor it's like the burn it gets in the way and it's the thing we need to stop and buffer and all all sorts of things

01:50:59 sure it's actually really a fuel it's a it's a tremendously effective fuel yeah is a is a strongly preferred fuel actually the is interesting this is a very classic case of Association um correlation versus causation right so the the original actually like there's a really cool history on lactate but it was originally found uh I think in Germany um pardon my history there some somewhere in

Europe and hunted Stags so one of the things is they sort of realized is like if we if we if we harvested a stag in a rest of State when

01:51:31 it didn't know we were there versus if we chased it and it was ran down that these lactate concentrations were significantly higher in in the latter situation therefore lactate started immediately getting this association between High fatigue points and it is easy to measure if you to do any sort of lactate test any sort of metabolic test you will see as fatigue increases lactate will also increase the assumption that was then oh my gosh it's the cause now we know like again it's not the thing it's in large part trying

01:52:00 to buffer the negative consequences of ATP hydrolysis and and some other things so it is certainly playing a part in that role but it is not a core driver it's also why you don't need to worry about doing things to quote unquote um reduce lactate in the muscle after exercise or to clear lactate or any of those things you may still want to do those activities but not for that reason lactate is fine you're actually going to use it in again the neighboring exercise muscle fibers in the same muscle another

01:52:31 muscle you can send it actually to the um to the liver and it can actually go through gluconeogenesis and it can actually replenish liver glycogen just as that fuel source or you can send the harder any number of sources you can also just sort of put it in circulation put it back in the muscle and once enough oxygen is there you can just kick it right back into either glucose or glycogen it's totally fine so it is obviously clear though once that number gets very very high other things are going to be happening that

01:52:58 are be causing a lot of hurt and this is your managing waste right is really an issue of managing what am I going to do with all this extra carbon what am I going to do with all this extra inorganic phosphate and some other nasty byproducts but that's the thing you have to deal with I'd love for you to teach me how different ratios of fuel sources are used depending on how long I happen to be exercising for example if I do a very short bout of exercise y typically that's correlated with a higher

01:53:29 intensity output I mean I suppose I could jog for one minute but here I'm thinking about sprinting for one minute or less which fuels are used is that mainly driven by fat stores by carbohydrate stores is it driven by dietary fat preferentially or carbohydrate that I've ingested if indeed I've ingested those or protein for that matter and then is we transition to exercise that goes a little bit longer you know anywhere from you know 3 to 5 minutes how do those ratios change and as we transition to

01:54:05 longer duration what most people think of as endurance exercise but long duration output of you know 20 minutes or more leading all the way up to a full Marathon how does that change the ratio of fuel sources that are used and I'd be particularly interested in distinguishing between carbohydrate fat and protein that's ingested so coming from food sources or carbohydrate fat and protein that are coming from Storage sites within the body okay great let's start at zero seconds and run all the way through marathon and we'll we'll

01:54:38 flag the distinctions where they start changing as soon as you want to create muscle contraction and power the very first source of energy is phosphor creatine that's going to power you for zero to maybe say 8 to 15 20 seconds of maximal exertion and that's in coming from the muscle fibers themselves yeah that is actually stored in the What's called the cytoplasm so this is a little area space in the muscle fiber um that's sort of like in this jelly-like substance and it's nice because one molecule of phosphor gives you

01:55:07 one molecule of ATP so it's not a big energy output but it's very fast because it is stored right there in the local exercising muscle right now if you need energy past that point say you know 10 or 15 seconds up to maybe a couple of minutes this is now you're going to have to transition because you're going to burn through that phosphocreatine it's going to be out you're going to have to move to now carbohydrate metabolism this is what we call anaerobic glycolysis so there's two phases of glycolysis now glycolysis itself means

01:55:37 glucose burning all right so just means we're using carbohydrate as a fuel source so initially when we start off this Cascade um which is going to take us again for a couple of minutes um carbohydrate utilization comes first from the exercising muscle so it's very similar to phosphocreatine that way if you start running low on it you can actually start pulling blood glucose and if blood glucose gets low you'll have to start getting glycogen from the liver to keep that up and we've sort of covered

01:56:05 that conversation all right so a little bit of chemistry here just give me a little bit of room here so now remember a carbohydrate is a carbon molecule that has been hydrated so one carbon attached to one water and remember water is H₂O most of the time when we're talking about glucose it is in a six carbon chain so six carbons attached to six water molecules all right great when I go to split this up through Anor robic glycolysis it works a little bit like this so you've got this six carbon chain

01:56:36 the first step is to snap that thing in half you're going to make two three carbon chains now we broke one Bond right there so we got a little bit of energy but not a tremendous amount um at the end of anaerobic glycolysis you're going to net something like three or four ATP so more than you get from the phosph triple or quadruple but still not very much there's another major

downside that's coming in a second to this system the upside is it's fast now one actually one adaptation we get to training in

01:57:06 this style is you'll increase your ability to store glycogen in your muscle which is great right we can actually biopsy you and measure the amount that you store and a training adaptation is awesome so you're able to sustain the system longer so perhaps 90 seconds into your interval training you hit a fatigue point and now you maybe can extend that to 100 or 115 seconds simply because you're storing more glycogen in the muscle before we have to then go into the blood and get it and form of glucose

01:57:36 so that's great so we've got this six carbon molecule and we split this in half we got that little bit of ATP and now we're in this little tricky position because this three carbon molecule is what we call pyruvate pyruvic acid and again chemistry folks I'm skipping some steps I'm going to intentionally make some mistakes here I'm making sure the entire world listening regardless of where they come in can follow me here okay so don't burn me on the details right you've got this pyate the problem is you can no longer do anything

01:58:06 with that glycolysis is over you've got to make a choice right in order to make something out of those three carbon molecules you've got to ship them to the mitochondria as we said that is the only place of aerobic metabolism right we cannot do aerobic metabolism anyway where else until we enter the mitochondria so anytime we cross that barrier we know we've automatically switched from anaerobic to aerobic well here's the problem if you were to take one more carbon off that three carbon pyruvate

01:58:35 you have to now do something with that carbon waste okay so before when we split the six carbon chain we didn't actually leave any carbons free floating we just split a two molecule in half when we go to split from pyruvate and make it into this two carbon molecule called acetel COA or seal COA now we've got a free Flo in carbon we have to have a strategy for that because that's going to increase acidity level any enzyme in our body that works to create fuel is very pH sensitive all right so if this thing if

01:59:07 pH gets off either high or low these enzymes can't work and that's really really important because even if I were to give you a direct injection of ATP remember that's that energy currency that's the only way we can actually form energy um I guess remember to clarify anytime we're using phosphor or glucose or fat which we'll get to a second we're not actually getting energy for exercise by breaking those down we're getting energy that we can use to then make ATP we break that ATP down that's what's actually powering muscle

01:59:34 contraction um you can go back to our previous episode where we walked you through the detail of the muscle contraction but that's what we're after okay so in the case of pyruvate if we split that off we have got to deal with that and the only way and the best way we can deal with that is oxygen remember we're going to breathe in O₂ that O₂ is going to combine with that free floating carbon make CO₂ we're going to Exhale that thing out that's our Waste Management strategy but that has to happen in the mitochondria remember if

02:00:04 we're using oxygen it has to be in the mitochondria so if we have the ability to ship pyruvate into the mitochondria we're golden but what happens if we don't why do we not well if we don't have enough mitochondria or our mitochondria are too small they're too far away or we don't have sufficient oxygen availability why don't we have sufficient oxygen availability because we created the pyate too fast and the demand in the mitochondria is exceeded by the buildup of pyate and so now we're having this giant backlog

02:00:41 and this thing fills up fast we have a couple of strategies here well when you're going through ATP and you're splitting it's called HP hydrolysis in of doing that remember ATP is Denine molecule and then the T part is triphosphate 1 two three which means you have three phosphates attached at the end when you break that phosphate off that's where you get your energy so now you have an inorganic phosphate and an ADP Adent die phosphate two that process requires water it's called hydrolysis as a result of that

02:01:15 you then have a free floating hydrogen and as you will know that is acid right that's potential hydrogen that's what that means and so you've increased the acidity in the muscle by breaking up all this ATP and so uh oh we're we're building up acid we have building up pyate we don't have nowhere to go with it and we can't cleave off a carbon because now we're just going to exacerbate the acid increase so what we can do is we can take those hydrogens that we're building up and store them on the pyruvate a pyruvate that's holding

02:01:49 an extra acid has a special name and we call that like lactate right so that's why we see this buildup of lactate so one of the downsides of anaerobic glycolysis is an incredibly High rate of waste production now lactate is not the cause of fatigue in fact if you think a little bit more carefully about what I just said it's actually stopping you it's what we call a acid buffer you can actually use it for a bunch of other things you can ship it to a neighboring muscle fiber in the same muscle that's

02:02:20 not working you can ship it to the Li you can ship it to the heart and a bunch of other places and then you can actually just work backwards so if you ship it to for example the heart and it's got a bunch of mitochondria that are free you can bring in the oxygen attach it to that hydrogen make water and now you're right back to pyruvate you put two pyruvate back together and now you

just make glucose so you can actually store it in the liver um this is a process called gluconeogenesis um through this fancy thing called the Cory

02:02:45 cycle which is what the proper cycle here is so you can use it as a very potent fuel source in fact a lactate is a tremendously valuable fuel source not only for exercise but for cognition and a bunch of other things so lactates in fact this is why um if you've seen any the research about pre uh exam testing exercise uh you'll see a noticeable increase in exam scores if you do a 20-minute bout of exercise prior to taking the exam and it's largely in part probably because of things like elevations and lactate how intense of

02:03:18 exercise uh would be most beneficial I don't know that exact answer I just know that uh generally any form of exercise is good but if you were to reach a reasonably high heart rate you're probably going to see in fact there's an acute and chronic adaptation here so Folks at exercise have better memory retention score exams Etc but then also doing it prior to that exam make sure you recovered and rested back down the straight but you'll generally perform better previous guest on the huberman Lab podcast who's the who's a

02:03:48 psychology professor and neuroscientist and also dean of College of Arts and Sciences at New York University NYU Wendy Suzuki is um religious about daily morning exercise yeah specifically for this purpose of enhancing learning in memory and has a lot of really beautiful data I consider one of the real Pioneers in this space um so if people want to learn more they can look to that episode or Wendy's work uh we can provide a link to a couple of the papers but this is fantastic in that it's incredibly clear I think for the first

02:04:20 time I'm understanding what what lactate is really doing um and it's dispelling a lot of myths that I think I and a lot of other people arrive to the discussion about lactate with what happens when the bout of exercise extends longer amazing so if we want to continue past that point we have to have some sort of strategy to get through it right we're stuck we're out of gas we have to then ship it to the mitochondria and now we're going to enter what's called aerobic glycolysis and this is going to take us anywhere from again say

02:04:55 that 90 seconds of all that work up to really 20 30 minutes in fact it really will take us to unlimited um if you look at a highly competitive marathon runner even those that are running say your two-hour Marathon those folks are burning up to 80% carbohydrate it is a it is not a fat burning thing and the reason is fat metabolism is way too slow it provides a lot of energy but it is incredibly slow if you're trying to run a 4 and a half or so minute mile repeated 26 times you have to be moving fast are they

02:05:27 ingesting carbohydrate as a fuel source during the race unless you're on the team you don't know they won't really tell you these are sort of Trade Secrets um it would be I would say fairly rare to not have something right there's a bunch of different strategies if you're going to go really long like some of these um like cycling where the races will be several hours then you actually might go to some fat as fuel sources I I know a lot of cyclists are using ketones and things like that now but traditionally

02:05:59 most endurance folks are going to bias heavily towards carbohydrate um now in one respect you're not going to run out of carbohydrates until you're many hours in these folks are are unique case but the average individual who who's doing an hour hour and a half cardio even you're not going to be limited by your carbohydrate stores you're going to be just fine you limited by some other things which we'll maybe sort of break down here in a second um but you're going to be fine there um a lot of those

02:06:27 folks will take carbohydrate though at very specific intervals you want to you do want to be careful though of ingesting too many fast carbohydrates prior to your exercise spout um we have actually have this little thing that's called the insulin glucose double whammy and what that means is when you ingest carbohydrates immediately your blood glucose goes up and that's depending on the type of carbohydrate and things like that well the same thing happens with exercise and so what happens is insulin

02:06:55 wants to start pulling glucose out of the blood at the same time muscle wants to start pulling glucose out of the blood and so we have this giant bolus of carbohydrate come in and then all of a sudden our blood sugar crashes and so if you're going to be doing so your your first half marathon or something like that and you're in those giant Corrals where there's like you know 100 people waiting to go and you're standing there for 45 minutes you may or may not want to slug down like three or four bananas

02:07:20 in a bagel and and and honey and things like you probably don't need that now not everyone experiences this double whammy but it has been shown in the literature to happen to some people so you want to just be a little bit careful um an easy way to combat that is just practice exactly what you're going to do in your race in your training it's like the simplest advice ever but you'd be stunned how many people do things uh during the race that they've actually never done a training I suggest people

02:07:46 do exactly what you described also for any kind of cognitive testing course before big exam is not the time to discover whether or not you can handle twice as much espresso or take a neut Tropic for the first time or uh or change anything I mean if if indeed the the score on that exam is is Meaningful to you you keep keep things regular so to to recap what we've done here is we

started off in the cytoplasm with this glucose molecule that is six carbons we took that thing we split it in half we call that thing anaerobic glycolysis we

02:08:16 made a little bit of energy but not much we take those three carbon molecules we ship them into the mitochondria we take each one of those we clear off one carbon each those carbons we take a breath in we attach them to oxygen we exhale them get rid of that energy we are now fully into aerobic glycolysis each one of those two carbon molecules we run through the KB cycle each round of the KB cycle Burns one two carbons so we go one two one two and now we've gone from six carbon molecule all the way

02:08:44 down to zero we used the hydrogens that we pulled off of that KB cycle run to go to the electron transport chain from there we made a whole bunch of ATP and so we have now fully metabolized one molecule of carbohydrate and the end product of all of it is simply ATP water and CO₂ beautiful and leads me to the conclusion that most everything is really about utilization of carbons and exhaling CO₂ is that how I should think about book ending what you just described this is why we started off the conversation with

02:09:21 the circle of life this is really a carbon gain this is why we call uh chemistry with carbon organic chemistry right that's what the whole thing is about any living being has to run through metabolism it's all a carbon game any living being has to use ATP this is all just a big fancy game of how do I make ATP and handle the waste remember endurance is all about Waste Management fatigue resistance the same thing and energy production we're playing a game here the whole game bring in energy use it mitigate waste products so when

02:10:01 thinking about aerobic exercise or long duration exercise in this case anything longer than five minutes for that matter five minutes all the way up to an ultramarathon the breathing associated with endurance exercise the heartbeating which of course is associated with the breathing and vice versa it's really all about bringing oxygen into the system that then allows those carbons to be used and within the mitochondria specifically and then carbon dioxide to be exhaled as we work through the carbon of the sort

02:10:36 of beads on a string is that right unless you're moving incredibly fast for a very long time and we're talking probably north of 90 minutes endurance is really not a game of making sure I have enough fuel it is simply managing the waste production and that's exactly what you described you need to bring in the oxygen so you can handle the carbon that's building up as a result of both the anaerobic and aerobic glycolysis that's our game here if we start talking about endurance events longer than that now we do have to start

02:11:09 worrying about running out of muscle glycogen running out of liver glycogen Etc or if we are at that 2hour Mark or so and we're moving very very fast but anything south of that is just managing carbon buildup and we do that best through oxygen utilization or getting more efficient and having a higher capacity for our anaerobic side so we can do that by having either more glycogen in our muscle so that lasts longer or building better acid buffering systems and there's a whole line of supplementation that are specifically

02:11:44 acid buffers there's a whole line of training there's a whole line of breathing to manage this that so we have a lot of strategies where we can maximize endurance all we have to do is go back to the earlier part of our talk which is figure out what's the actual limiting step and then train according to that or to your strategy your nutrition your supplementation that defeats that limiting factor for an example if you are trying to maximize your performance in this 20 second maximal burst and your strategy for that

02:12:17 was to make sure your muscle glycogen is saturated it's probably not going to help a ton because you're not going to be limited by total fuel you're going to be limited by your ability to buffer acid however storing more glycogen in your muscle in preparation for a marathon is a tremendously effective strategy because that will become a limiting factor so what we can do actually next if you'd like is we can just walk through these and look at the individual limitations where the failure point happens and that effectively will

02:12:47 outline your strategy for improving them so you taught us about carbohydrate utilization as a fuel source what about fat and what about protein great I'll start with protein because it's easy it is generally at best going to represent 10% of your energy output now that will grow over time in terms of if you did a several hour B of exercise uh when you started doing it you might be using 5% of your energy from protein and then that might grow to 10 or so and that happens because you start running low on

02:13:21 muscle glycogen you start running low on liver glycogen you start then having to pull in energy from another place so like as those numbers go down you'll see an increased uptick of energy from fat as well as protein having said that it's not a tremendous fuel source um it is only aerobic so it has to be oxidized those are the same thing when I say oxidized you use oxygen to burn something to make a fuel um so it's not a significant contributor to energy in that regard uh and unless you're talking ultramarathons are longer

02:13:56 and it is also not something that can enhance performance and so we don't really need to talk much more about it than that um in terms of fat as a fuel source now here's the fundamental difference while carbohydrate starts anaerobic and finishes aerobically in the mitochondria you're using mostly the carbohydrate in the exercising muscle tissue eventually you

can pull from blood and then you can pull from the liver with fat you have a tiny amount stored in the muscle intramuscular triglycerides but the overwhelming

02:14:28 majority of fuel you get from fat comes systemically and so now we have a fundamental difference we actually literally have a Time problem I can get energy from carbohydrates faster because it is directly there if I go to pull it from fat I've got to pull it from the rest of the body which is why somebody who loses fat loses it from their entire body despite the fact that they may be only exercising a couple of parts so think about a runner someone who lost a lot of fat running you don't see them

02:14:59 just lose fat of their legs it comes from their face and their neck and everywhere why because what you're going to do is pull fat from the entire system you're going to break it down through a process called lipolysis which means you break it down from the stored form um you put it in the blood as that glycerol backbone which is that three carbon Backbone in the individual fatty acids it's going to float through the blood there's a seven step system here but we'll skip it for now it's going to

02:15:24 have to get then uptaken into the muscle in the muscle then it has to get taken up and run into the mitochondria now that backbone that three carbon glycerol backbone is actually going to function almost exactly like the three carbon pyu just get it into the mitochondria cleave off one carbon run it his AOA bada bing bada boom exact same thing super easy to metabolized small enough to go through the mitochondria membrane the fatty acid change become a problem so if you have a chain that's longer um than eight or so

02:15:55 carbons it has to actually go through a special transporter on the cell wall to get in and that's going to be limited by a thing called carnitine and you're probably familiar with that as a supplement you may have talked about it there's a lot of places that make it um that's going to be a limiting factor if it is a smaller what we call a short chain or even a medium chain triglyceride which a lot of folks have heard of MCT that's what we're talking about that can actually go Direct directly through because it's small

02:16:22 enough to pass through and you can use it immediately as an energy source in either case the way that you finally metabolize a fatty acid is a process where you would go through and cut off two carbons at a time why would you cut off two because you're trying to make that two carbon acetal COA so you can run through that KB cycle again because you're cutting off two carbons at a time we have a special name for that oxidation process it's called beta oxidation that's exactly why we call it beta oxidation two carbons in you cut it

02:16:56 off to make that asot tooa so you can notice the oxidation pathway the electron transport pathway is identical whether you're talking about the carbohydrates or the fat in fact it doesn't even matter more to our point if we're talking about simply fat loss it really just is about running that electron transport chain whether it came from a carbohydrate original Source or a fat original source it ends up in the mitochondria as basically the exact same thing it then ends the end of metabolism as the same thing remember the final end

02:17:31 point of carbohydrate metabolism is water ATP and CO₂ do you want to guess the final end point of fat metabolism it's water ATP and CO₂ so practical applications here if you want to maximize f loss what type of training is best it really doesn't matter if you enjoy longer steady state stuff fantastic if you enjoy intervals amazing if you would like to do a combination that's my personal preference that's great too you have a ton of options pick what you think is a combination of challenging not all exercise should be

02:18:13 easy but you will actually enjoy somewhat or you're willing to accept and anything that you absolutely hate don't do it times is very very very difficult to do high-intensity training you have to really be interested in doing it if not it ends up turning into like moderate intensity training you sort of just check the box and it doesn't work that well if you're just checking the box so if you're like man mentally I don't have it in me today to get to a high heart rate and throw up and all that stuff cool but you can just do some

02:18:42 moderate steady state stuff well that's a win great if you're like oh my gosh more than 10 straight minutes and I'm so bored and you're all maybe you're also like I don't have 45 minutes I got to get this done in 8 minutes great go do some high intensity intervals either option will be equally effective as you mentioned earlier exercise is useful for aesthetic changes functionality and for longevity but when thinking about exercise specifically for fat loss I do have to ask this question I often hear from people that they prefer

02:19:17 one type of exercise versus another for sake of fat loss because certain forms of exercise make them very hungry I'm wondering whether or not there's any relationship between the intensity or type of exercise and the uh hunger stimulus now I don't have this problem because basically everything makes me hungry um and yet I'm also okay fasting for part of the day yeah I'm one of those pseudo intermittent fasters talk about what I mean by that I just happen to eat between 11:00 a.m. and 8:00 p.m. naturally I I'm not

02:19:49 religious about it but um but I don't do it for any other reason except that that tends to be when I'm hungry and I exercise outside of that um in the morning typically in any case is there a way that people can determine what type of exercise might be better or worse for them based on its appetite stimulating or inhibiting effects because I also hear that you know some people will go

for a long run and then they are quote unquote not hungry for several hours afterwards does that have anything to do

02:20:18 with which fuels are being utilized during different forms of exercise that's actually a really good question I don't know the the mechanisms that could explain that answer what I can tell you is you hear the same comment for physical activity in other words people say man if I do this type of training then I just am exhausted and I lay around the rest of the day so my total caloric expenditure is actually compromised as an aggregate because I'm down um the data would suggest in general that doesn't happen so most of

02:20:45 the time we don't see a reduction in physical activity um with either high intensity or steady State training in fact you generally see uh equal if not increased what's called neat so it's the non-exercising part of your day um in addition to the basil metabolic rate so physical activity wise you don't send to be Pro now hunger is a little bit of a different thing the answer here is I don't think we have time to actually do justice on this so perhaps best to to not get into this one yeah why don't we punt this

02:21:14 down the road to our discussion about nutrition specifically and and weave back to it so we'll earmark it for that um meanwhile it sounds like if one is thinking purely in terms of uh burning calories yep and getting the health benefits of exercise to create a caloric deficit to create fat loss it doesn't matter whether or not they burn those calories using a form of exercise that relies predominantly on carbohydrate fat or protein correct it's not that it doesn't matter it's that either one will

02:21:45 work because when we say things like that it's it doesn't mean they're actually identical they're are some slight differences and maybe those differences are important for some people and not others I says either one is a viable strategy great what about protein as a fuel as an actual fuel so here let me give you an analogy imagine that you are you were with me a few weeks ago in southern Montana and we were out um in the wilderness for a week okay and it's cold out there and you needed to make a fire

02:22:14 uh and if I said look you can pick any of these things there are some there's some wood over there we brought some newspaper and then we brought out a match and we need to create a fire we're going to use that fire to energy and heat up okay I said great the very first place you would probably start to make that fire is the match you like the match and any match hey it's going to light immediately but it's probably going to last five to 20 seconds I don't know before it burns out that's fossil creatine real fast real Burns out if you

02:22:45 were smart you would take that match and then light the newspaper on fire right now if you were to burn a whole newspaper uh it is more energy then you get to the match but you still you know I don't know what's it going to take a few minutes some number of minutes before an entire Newser burns up five I don't know right depends on the which type of newspaper it is I guess right amazing that's carbohydrate right if you were really smart you would use that to then light a piece of wood on fire and a wood if

02:23:13 you've been in the wilderness it could last hours days it's really quite unlimited your phosphor storage is very Li limited small glycogen is a lot higher because you can store it in muscle you can store it in other places so you have more but not a lot fat is unlimited the average person if you're around say 70 kilos up 170 pounds or so and you're moderately lean maybe 15% body fat nothing crazy you probably have enough stored fat to create enough energy to survive for more than 30 days right this would literally be if you

02:23:48 ingested zero calories you have enough fuel in your stored fat to keep you alive for certainly 30 days you wouldn't feel good and all those things but energetically basically fat will never ever be your limiting factor to Performance so when we start talking about what limits my performance in these areas you can just wipe fat off the list it will never be your limiting factor to any type of endurance performance you simply have way too much the only problem with f is it's just too slow I've got to mobilize it I've got to

02:24:22 get it in the blood move it that whole thing too slow so if I want to go faster I will never be able to fully utilize fat which is why we talked about earlier you'll never see a situation in which somebody is 100% burning fat as of fuel and no perent carbohydrate it's always going to be too slow highest you'll get maybe 70 so per. protein in this equation is none of that now you may notice how do you make paper but fibrous you combine with water that you it gets pressed it gets compressed yeah yeah

02:24:56 it's made from wood how do you make a match it's made from wood what's carbohydrate a chain of carbon what's fat a chain of carbon these are similar molecules right they're meant to give you pros and cons it's very difficult to just light a log on fire without a lot of work you'd have to burn burn burn burn so these are complimentary systems that are really close to the same thing protein is none of those things protein is more like a piece of metal so if you were out in the woods with me and we were trying to make

02:25:29 a fire and you're like hey look I found some old uh railroad over there let's throw that on there I would probably look at you like you're czy now technically can you melt metal sure but you're going to burn a lot of energy to try to get a little bit back out of the metal and now you've also cost yourself a very very valuable structure so protein is a fuel source for exercise or metabolism it's

just an incredibly poor choice your body will do it again maybe 5 to 10% but you now you're burning a

02:25:58 very valuable Supply in a situation in which you don't know where there's ever going to be anymore remember protein is fairly transient it's you're not very good at storing it you can store a ton of carbohydrate and an unlimited literally amount of fat so you just really need to disregard thinking about protein as a fuel source your body does not want to do it you're not good at it you can go through a process of gluconeogenesis from protein make glucose from it it's just very poor you're not going to get much out of the

02:26:29 exchange and you've burned your supply of metal which is going to be very difficult um it's a very high commodity in the woods or the Wilderness to have something like metal for people that consume very low carbohydrate or zero carbohydrate diets are they pulling more energy from muscle so which I imagine is a conversion of amino acids into ready carbon chains yeah I mean in this particular case once you've reached um a certain level of adaptation you've just gotten extremely good at generating

02:27:00 glucose from other Fashions right so you can bias heavily towards fat adaptation the downside is and we've seen this born in literature you're going to perform slower so if you don't care about maximizing performance especially over something where it is a maximal effort for a few minutes or something then maybe you're not concerned and and that's absolutely great ESP especially for people just don't exercise then hey gez very little concern here but if you're interested in your performance and you're wondering why you're just

02:27:28 like slugging it down well what you've done is you've downregulated the ability literally the enzymes responsible for that entire Anor robic glycolysis portion they get downregulated which means there's not as much around anymore and so you get really bad and slow at using carbohydrates as a fuel source so it's a very poor strategy for people in an aerobic based sport or who like that type of activity again if you don't care no problem um if you don't exercise at all then you really have no problem there which is

02:27:54 actually why a high fat low carbohydrate nutrition strategy for people who don't do much physical activity is probably like well it's very effective it it is a really good strategy for weight management for energy stabilization throughout the day and the research would very much support that in my observation I would agree I've tried low carbohydrate diets of severely limiting or completely eliminating carbohydrate and after about two or three days I feel pretty lousy but mostly because I want to train very intensely right in the gym

02:28:28 in addition to doing longer runs I tend to do all of those things across the week yeah uh but I've also observed and in fact know several people that love the very low carbohydrate AKA keto ketogenic type diet they're not doing ketogenic diets for mental health reasons per se um but indeed those people tend to do very limited exercise or they tend to do a lot of long endurance but low intensity long endurance these are the I walk to get my exercise types and they do indeed walk a lot and some of them manage to um

02:29:01 control their weight very readily and like that diet for that reason U when we had Lane Norton on the podcast he um pointed out quite aptly that in order to lose weight you have to restrict something either time or um macronutrients Etc to arrive at that um sub caloric threshold um get below the the sub maintenance threshold I guess one of the things I want to point out is this should be received as again not a this is better or worse this is just you now have a ton of options so whatever personal preference other

02:29:32 factors you get to craft this strategy of performance Aesthetics and health based on your personal preferences at this point I'd like to go back to our classic list of nine adaptations that exercise can induce the first four of course being largely unrelated to today's conversation but that were covered in the episode that we did on strength speed and hypertrophy so just to remind people the nine adaptations are number one skill and technique two speed three power which is speed times

02:30:08 Force four strength and five hypertrophy today we're talking about the remaining adaptations on that list starting with muscular endurance followed by Anor robic capacity followed by maximal aerobic output and finishing at number nine with long duration exercise so if we could start with muscular endurance this would be uh number six on the list of nine adaptations muscular endurance how do I build muscular endurance why should I build muscular endurance and just to remind me what fuel sources are pred dominating when I'm

02:30:52 training for muscular endurance great so remember muscular endurance is something that's going to be generally in a local muscle it is not a cardiovascular or systemic issue and it tends to be something in the neighborhood of say five to maybe even up to 50 repetitions so this is the classic example we give here is how many push-ups can you do in a row most people are going to land somewhere in that range I just said how many sit-ups can you do in a minute how many pull-ups how long can you hang on a

02:31:19 bar um as a dead hang things like that that's muscular endurance muscular endurance is not a mile run or a marathon or anything like that so how long can I stand without breaking posture this is muscular endurance a plank a walls sit great yes love all these things okay now the reason I took you on that big long metabolism journey is so I could help you understand

exactly how to train this factor or any of these factors with a more comprehensive understanding what's happening meaning thinking back to the

02:31:53 metabolism if I'm going to ask my triceps to do 50 push-ups in a row what's going to be my limiting factor am I going to run out of fat no chance am I going to run out of glycogen no chance that's way too few of repetitions you have a lot left there so what's going to be the thing that stops me from getting 51 repetitions either you're going to have too high of a pH rise so too much acid build up or you're going to have a problem clearing the waste so really this is two factors dealing with acid buildup and

02:32:31 getting acid out of the muscle tissue and into circulation because you have plenty of ability to handle that small amount of acid buildup in your entire body it's just you can't handle it in that tiny spot now I picked the tricep for a very specific reason you're going to deal with more pain when you use a large muscle group like your quads or your glutes than you are with a small muscle group for example nobody ever threw up after arm day but a lot of people throw up after leg day why is that look at the total amount of waste

02:33:04 that you're dumping into your system when you have quadrupled or 10x the muscle size small muscle groups are only really going to be challenged in that local area large ones will dump so much waste into the system that you'll want to avoid that as quickly as possible and that's one of the reasons why you throw up after Hard Exercise great so the reason I'm laughing because I don't think I've ever thrown up uh from a weight training session and so it's making me wonder if I've ever trained that hard I've

02:33:35 received uh or obtain the progress that I've wanted to generally over time not every week every workout every month uh uh but certainly over the 30 plus years that I've been weight training I've achieved the the results I wanted I have however uh vomited after a long long run when I didn't hydrate well oh or if I drank too much water sure oh sure too much water yeah you'll you'll get that out quick right I just uh want to be clear because I think some people are getting the picture that if they're not

02:34:01 vomiting at their after their leg workout that they're not training according to uh your standards Again by the way um Dr Andy Galpin runs experiments in his lab he recruiting subjects all the time uh also known as my graduate students that's right in any event sorry to interrupt uh but I felt it was a necessary interruption so muscular endurance there's plenty of fuel plenty of fuel you manage acid build up and you also need to get that fuel out of you that's going to be a capillarization issue so the way that we can think about

02:34:33 this is capillaries surround your muscle and the whole point of them is so that blood can come into them they hit this capillarization that actually slows the diffusion rate of blood down and so you can exchange nutrients in and get waste products out and then we get things back in circulation so the more of those you have the better you are at dispersing any of these waste products build up whether it's CO₂ or the acid so the adaptation you're looking for here is an increase in capillarization potentially

02:35:01 a slight increase in mitochondria but the time is too fast right so we're going to be able to need to do these 50 repetitions in say under a minute or something like that so getting the mobilization into the mitochondria getting fuel that way too slow that's not really going to get our performance here so what are strategies to increase acid buffering ability and then capillarization so on the capillarization side you simply need to train at that ability so you go close to failure and practice that often that

02:35:32 alone will increase increase blood flow to that local area which will get take you through your process of increases in capitalization easy peasy specificity there just to briefly interrupt I find it remarkable although not surprising giving how amazing in the human body is that simply by doing some movement repeat like a wall sit or a uh or push-ups or dips for that matter repeatedly over and over and over until you reach that failure point Y or that quaking point in the case of a wall sit that provides a stimulus for more

02:36:10 capillaries to be built into the system literally the production or the um the trafficking of endothelial cells which make up the capillaries and basically little pipes feed the system with and remove waste products it's like irrigation right imagine you had a giant field and you had two big pipes running down the outside well in fact if you want to make sure water gets evenly dispersed across the entire field you'll have a bunch of off-shooting little pipes and the more of those you have the more coverage you

02:36:39 get do we know what the specific signal is that says hey I failed at this we need more capillaries I actually don't know what that is I could I would speculate it's a combination of um acidity as well as carbon dioxide and probably some nitric oxide stuff happening there but I actually don't know I'm guessing nobody knows for sure because we still don't know for instance what the exact signal is for hypertrophy it's kind of an amazing situation we know the requirements for getting the result we want yeah but we still don't

02:37:09 know what the specific signal is um in any event what I'm hearing is building more capillaries is great for enhancing muscular endurance and the way to get more capillaries into those muscles is to train for muscular endurance by getting close to failure or to some point where you simply can't continue for whatever reason could you give us an example of what a reasonable

training protocol might be in terms of um the classic Galpin list now of exercise Choice maybe a few um options order volume and frequency great what should

02:37:46 we be doing how often should we be doing it and you know for instance I do walls sits to failure then push-ups to failure uh given that this is a local process I'm guessing that if I do push-ups to failure I'm not going to increase the number of capillaries in my legs very much correct so you nailed it exercise choice is high Precision here so pick the muscle group and the exact sequencing and movement pattern you want High Precision this is the thing if you want to get better at a plank hold a

02:38:15 plank if you want to do more push-ups do more push-ups you can do some other stuff that's complimentary but really this is a high Precision game do the exact same thing for exercise Choice very simple there okay in terms of exercise order I suppose this dovetails with volume yeah can I combine um training let's say wall sets for my quads and you know nearby muscle groups and then do push-ups to failure uh and then also do some sort of um pulling exercise to failure yeah absolutely again pick the exercises you want the

02:38:46 movement patterns you want to do and do them the order Almost Doesn't Matter with the one caveat with larger muscle groups particularly again multiple leg activities that will induce a small amount of systemic fatigue and so if you I guess theoretically wanted to maximize your push-up number and you did a whole bunch of say split squats um and you just did those and and you you know did lunges for a mile or something like that you might actually slightly compromise you might not but you might

02:39:16 slightly compromise your ability to do as many pull-ups in a row or hold a bent over row or something like that so if you really cared about that level um then you maybe want to do the one that's most important first in general my recommendation though is to do the bigger muscle group first how many sets and how often should one perform training for muscular endurance and when now the lovely part here is we've moved down the Spectrum past hypertrophy you don't need a lot of load here in fact the load only needs to be

02:39:46 at or slightly above what you want to move move so if you want to get better at moving 50% of your one rep max you don't really need to train much more than 50 maybe 55 or 60% of your one or Max because if you go higher than that the repetition Count's going to fall and you're no longer going to be training muscle endurance so you just need to stay right around that number that you want to work on so again if the target is doing more pull-ups and assuming that you have the strength to do it and you

02:40:16 check that box you simply need to practice the repetition range that you want to be in that's all it takes you can repeat that a number of times but because remember the volume is fairly low the load is very very low you can actually repeat these quite frequently so you won't get extremely sore for muscular endurance relative to traditional hypertrophy straining because the load is very very light so you can do these more frequently if you would like more frequently such as you could do it three or four times a week

02:40:47 easy if you would like you don't NE need to 3 days a week per a muscle group is probably fine here um if you wanted to do more sets on a given day and do less days that would be fine so if you wanted to do two days a week and you say wanted to do let's say you could do 25 push-ups and the goal is to get to 30 push-ups just as an example you might say okay I'm going to do sets of 17 and I'm going to do three sets of that I'm going to do that three days a week that's going to build up quite a bit or you could say

02:41:20 look I'm going to do a set basically to failure I'm going to recover and do one or two sets that say 80% and I'll do that twice a week that's going to push the pace pretty well you're going to have a lot of uh gains from that and again this is not about hypertrophy this is about muscular endurance correct so I do want to emphasize and again please correct me if I'm um talking out of line here do want to emphasize that because we mentioned pull-ups you know if you can't get 25 five pull-ups then and you're doing 10

02:41:52 you're training for hypertrophy you're not training for muscular endurance per remember there's a big cross over here so anytime we're talking past like 15 reps we're technically in hypertrophy and muscular endurance got it so here's a common mistake I don't want to get bulky so I'm I'm going to go lighter and do more reps and then people grow and then you landed still right in the middle of hypertre range right so like for people are like oh my gosh like every time I lift weights I go lighter

02:42:20 I do more reps and I you're still right in the hypertrophy Zone they'd actually be much better off training very very heavy in the one to three rep range they'd get really strong and they wouldn't grow much exactly MH so tell me if this is a reasonable protocol for what I'm going to call the typical person in my mind the typical person is somebody who hopefully is doing resistance training hitting that 10 sets per muscle group per week minimum yep to maintain or build strength and hypertrophy but is also doing some long

02:42:53 duration training that we'll talk about in a little bit maybe throwing in a high-intensity workout here or there some Sprints maybe some plyometrics some skill-based training doing a bunch of different things to be all what I would call all-around fit yeah they're not training for any specific event or trying to maximize any one of the nine adaptations to the exclusion of the others

that person decide okay after um they do this their longer run they're going to do a Max time a plank to Max duration they're going to do a wallet to

02:43:27 Max duration and they're do push-ups to Max duration and then also do that same workout before they do their high-intensity interval training some other point during the week and then maybe even do it uh again um on their a so-called rest day just a real quick five minutes of and in doing so build more capillaries into relevant muscle groups and build their muscular endurance yep without eating into their overall recovery too much too much yeah so again the nice part about this is they don't Hammer you too much you're

02:43:59 not going to get tremendously sore if you keep the load light the only switch I'd make there is I would probably do them after your interval rather than before so you can make sure you keep quality there uh and you're not compromised by a local muscular endurance when you're actually trying to get a more systemic fatigue with something like a higher intensity uh interval training so that would work fantastic the only other variable we have in hit on here is progression and this is very simple try to add a rep or

02:44:25 two per week that's really all you have to go after so if you're up to 22 this week try to hit 23 next week or for wall sits and planks that would mean add add time time yep and if and if you run into a wall there just like the same Concepts we talked about with strength or hypertrophy back it down to more like in the 80 or 85% range and accumulate a lot more practice that's going to help help a lot with capitalization as well as acid buffering so you're going to continue to give yourself signals for

02:44:55 upregulation um of the processes needed for that and it's not always pushing you to the end failure just like we don't want to always go to failure with strength we don't want to always go to failure with high intensity rules either same thing would be happening here what about Anor aerobic capacity how should people train for Anor aerobic capacity what exactly are they training for meaning what is the structural or seller adaptation or adaptations that are occurring that allow for increases in Anor aerobic capacity and why are

02:45:23 increases in aerobic capacity good for us even if we're a quote unquote endurance athlete or we are a recreational exerciser who is not interested in building more muscle speed or things that I typically associate with Anor aerobic capacity yeah so this is really really fun remember Anor aerobic capacity is the total amount of work you can do for something like seconds to a few minutes and this is extremely high levels of fatigue the highest you're really going to see and by fatigue here I mean acid

02:45:56 build up byproducts not fatigue as in like mentally I don't want to do this anymore so if we just think about the energetics for a second I'm going to do say uh let's take a really easy example of people have done that thing where you uh you don't go to the track and you sprint the straightaways and you walk the corners yeah remember that sort of thing yeah uh tatas 30 on 30 off things like this like this is what we're talking about um in this kind of anaerobic capacity area now here's what's going to happen is fat

02:46:29 going to be your limiting no we already made that clear right what about carbohydrates well if it's a single bout or a two or three bouts probably not but if you're doing this for a long time say you're going to go 30 on 30 off for 20 rounds you may actually start reaching a point of running out of M muscle glycogen in any of those cases though you're going to be running into an acid problem if you were to continue to do this multiple repetitions in addition to running low on muscle glycogen you're

02:47:00 also going to start running into oxygen transportation problems because you're building up a lot of byproducts you got to continue you will actually cruise into aerobic glycolysis this is exactly why uh the community that I have worked a lot with um professional fighters very high level boxers world champions UFC fighters it is a five minute round that you're going to do five times this is for world championship fights you get one minute break in between so imagine going like 30 on 30 off for five minutes

02:47:30 getting a one minute break and doing that five times even though the individual bouts are 30 seconds long the entire thing lasts so long it is primarily aerobic you have to have both capacities you got to get really high anaerobic you also have to have a lot of aerobic going on you have you're going to start running into limitations because of heart rate stroke volume and then even potentially ventilation the need for oxygen to be able to come in and clear the carbon dioxide totally out of the system

02:48:01 becomes a problem because not only are you having so much buildup for such a long time you're also using multiple muscle groups so now this is a very important distinction muscular endurance tends to be localized now this is not right if you're doing these intervals you're on an assault bike you're sprinting up a hill you're grappling with somebody you have a lot of muscles being involved which means all of that waste is being dumped into the central part you have to clear it and I'm by clear it I now mean not out of the

02:48:26 muscle I mean out of the body so your ability to bring in and utilize oxygen is going to be a major limitation to your ability to handle this stuff so what do you do well specificity wins practice the exact thing you're talking about so if you want to get better at sprinting the straightaways and walking the corners do that you can't always do it though you're going to run into

limitations so this is when backing off to a lower intensity is going to give you a lot of benefits we know very clearly if you

02:48:57 want to improve cardiovascular fitness high intensity moderate intensity and low intensity you're effective and you actually probably want to do a little bit of all of them this is why none of our Fighters would ever just do high-intensity training there's going to be some moderate um we tend to call this like cardiac output training um you can think of this as like any anywhere between zone two to zone four if you like zones I don't use them personally so I'm just going to intentionally interrupt you because this issue of

02:49:28 zones has come up a few times and I want to make sure everybody's on the same page you also mentioned that you don't necessarily favor the Zone nomenclature but for those not familiar Zone one 2 3 4 all the way up to five is a kind of U back of the envelope uh type verbage some people and is more PR precisely followed by for other people meaning for me uh Zone one is simply walking uh easy walking zone two would be for anybody the pace or intensity of exercise that one could perform while still

02:50:07 maintaining a conversation but just barely meaning if you were to push any harder then it would be difficult to hold that conversation then you'd be in zone three and then Zone 3 four five as I understand them are a little bit vague U but maybe you could give us a sense of the breathing patterns associate with each of the zones so that people could um map to those uh when we discuss Zone one through five uh and as I say all this I certainly um tip my hat to all of those people out there who like to

02:50:42 measure percent of maximum heart rate um they like to use heart rate monitors um they're using any number of different devices I sometimes use those devices but in general I tend not to and I use my breathing as a Rough Guide of which zone I'm in so before we go back to specific protocols for Anor robic capacity tell me how you think about Zone one through five and how people might be able to assess whether or not they are in zone one two three or four or five great so zone five is that absolute top thing and

02:51:13 we can flag ourselves there I liked how you flagged one and two the distinction between three four and five I'm I'm less concerned with either uh we will do some heart rate stuff but not to identify what zone we're in um the fact is the distinction between those zones is basically just made up right not that it's fake but there's no like rationale there it's a little bit like perceived effort in weightlifting you know how are you at 100% output or 70% you know when you're at zero and you know when you're

02:51:42 at 100 in that moment but the difference between 60 and 70 is anybody's guess totally so we use or the relevance right so why does it matter if I'm at 60 or 70 is there actual difference there's not right so it doesn't really matter in that regard um if you're a very highly trained particularly cyclist things like that then and you can control a lot of circumstances those things start to make a lot more sense um but when you're in an open environment like the athletes I deal with it's just not going to it's

02:52:09 not going to matter that much so um the way that I approach this is and I will use this word intentionally stolen directly from Brian McKenzie and his company shift adapt um they use what's called a gear system and I absolutely love it it's what we've been using for a long time so with Brian with your permission I'm gonna take it right now thank you Brian you gave me the permission thank you Brian Brian's a good friend of ours and I do think the breathing gear system is a terrific way to think about the zones

02:52:39 and to get a good sense of what zone one happens to be in yeah great so um the first gear is your ability to simply breathe in and out through your nose at a set Cadence so basically regardless of how hard you're working can you restrict your breathing to like a 2 to 3 second inhale and then a two to 3 second exhale and this is really clever actually because a lot of folks will jump immediately into an over breathing strategy which means you'll be ventilating more than you need which actually sends that reer up higher than

02:53:11 it needs to be which kicks you higher into carbohydrate utilization if you're supposed to be in quote unquote Zone one you you're trying to be efficient not fast so using more carbohydrates than you need is not beneficial here um you're walking for the day you're out on a longer hike you're you're enjoying the day you shouldn't be trying to ramp up carbohydrate metabolism it should be efficient and so this would be getting into an argument with somebody while on a long walk you feel exhausted

02:53:40 afterwards you over breathing yeah totally right okay yeah so you should be able to breathe at a specific Cadence and generally people are um doing that more frequently than they need right zone two uh rather Gear 2 is inhaling and exhaling at whatever rate you need to be but still nasal only so it is a force right whatever you need to do but your mouth has closed the entire time you shifted higher up you're burning more and more carbohydrate as a fuel source but you're still able to control

02:54:14 that and restrictor through nasal breathing now gear three and four which are final ones there's no gear five gear uh three and four is like a subtle Extinction I actually don't even care about the difference there I basically use gear one two and then S4 but you're basically talking about either a nose to mouth strategy or a straight up mouth mouth right so breathing in through the

nose out through the mouth if you can control it that way you can do the opposite actually right can you breathe

02:54:39 in and out through your nose but the classic one people do is in through the nose out there the mouth um again I really don't even care about distinction I basically jump from two to four a Brian may do it differently I don't actually know um four is just mouthmouth right and this is the case in most sporting applications you're going to be breathing because the nose is restricted right there's only so much space and as we talked about earlier the consequences of not having enough oxygen in or CO₂

02:55:06 exhalation if you're restricting that this is going to be problematic so in your actual competition please go to the mouth if you need to right we practice a lot trying to stay nasal only for as long as possible um but that's going to eventually happen when you're doing your high-intensity intervals and you're really going as hard as you can you're GNA have to go to your mouth unless you're an absolute Freakazoid and you can stay in your nose but that's not going to happen right most people can't

02:55:31 get past say 70 or 80% while breathing through your nose um I know some people can get higher but that's the general distinction so we pay much more attention to those particular gears than we do heart rate zones and zone five would be just pure mouth breathing all out running for your life system is just one to four there's no fifth gear got it so the gear four would again be mouthmouth breathing as much in as you can breathing as much as you can out got it and I appreciate your description of the gear system and how it um

02:56:00 roughly relates to the zones we've been talking about I also um am reminded if anyone wants to experience the relationship between breathing and the offloading of carbon dioxide and your ability to exert effort in anything uh a game that a friend of mine sometimes likes to play when we walk or Jog and talk is he'll say let's just hold our breath now until we hit that piling or that um uh lifeguard stand on the beach and within seconds you actually can start to panic it also becomes very hard to coordinate your action after a little

02:56:34 while again be really careful with this but but it will teach you in a moment in a very real world way how important it is to be able to offload carbon dioxide because you're probably not running out of oxygen at those lower intensities You're simply building up carbon dioxide and that gas reflex is screaming to go off and you're actively suppressing it yeah so the interesting test here is your CO₂ tolerance um on Brian's website you can go directly there you can there's a video to how to run this test

02:57:01 and then you can put in your numbers and it'll tell you sort of exactly what to do as a result of it but the CO₂ tolerance test is a test of exactly what you just mentioned so you should be fairly tolerant in other words non-reactive you can be responsive but non-reactive to elevations in CO₂ so you should see them and feel them but you should be choosing how you respond rather than an reaction um there are interesting data looking at things like out of the blue panic attacks you can actually notice those in blood via rises

02:57:32 in CO₂ up to 45 minutes prior to the event app happening so there are signals happening in your body um that you may be sensitive or not sensitive to the more in tune you can get with that the better your life is going to be um and even if we're specifically just talking about exercise performance so it's okay for CO₂ to rise it's going to rise it's a byproduct of Anor robic anaerobic metabolism it's a byproduct of carbohydrate and fat metabolism as we've established it's going to get there you're going to feel that however if you

02:58:04 immediately go into a panic because of a small increase in CO₂ this is a problem so returning to Anor robic capacity this morning we were training not together I couldn't keep up with your workout but I uh but in the the same uh General space and I did my once a week maximum heart rate uh one minute Sprint on the assault bike sometimes I'll do more minutes uh meaning I will do a one minute then take some rest and do another minute after some rest but I decided to do that one minute with you there so I could learn

02:58:35 from you and indeed um I have to assume that that was largely within the Anor robic capacity um realm the first 30 seconds or so were manageable we gain more and more pain mhm there was a quit signal going off in my head you said there's real magic that occurs around second 40 and indeed somewhere around 240 for whatever reason it seemed easier but at the one minute Mark I was happy to stop because I was really at at least what felt to me uh 100% output yeah is that a good protocol for building up Anor robic capacity

02:59:08 keeping in mind what you said before which is that specificity or precision as you phrased it um is important that is if I want to train uh interrup capacity for Sprint I probably should have been sprinting cycling I was I was on the assault bike um and so on how many of those one minute allout Sprints or 30 second allout sprints on the on the bike could and should one perform per workout and per week so marching through exercise Choice yep let's do it um order volume frequency and progression yep choice of exercises

02:59:44 train for what you want to improve is that right not necessarily so in this particular case if you have a specific goal yes of course Do It um exercise Choice a couple of things you want to look for you want to pick something that you feel extremely confident in the movement with because you're going to forget your brain very quickly here because you're going to go into our pain

cave cave so if you're not comfortable running don't go run here uh you're never going to get to the spot we need to get to it um if you're not

03:00:15 comfortable if every time you you go on a rower your low back hurts the next day don't do it if you're not comfortable using kettle bell swing you get the point don't do an exercise you're not comfortable with you also secondarily want to be careful cautious of heavy Eccentric loads because you're going to be doing a lot of repetitions at a high intensity so this is where I love an assault bike this is why a rower is great swimming is amazing running uphill generally more favorable than running on

03:00:42 um normal ground especially if you're not Runner don't run downhill that's a lot of Eccentric load um I don't love things like box jumps here right because again a lot of Eccentric loading if suppose you can jump up land on the box step down but now you're you're again you're too many things are going through your mind I don't want to slip and fall I don't want to smash my shin on the box what happens if I too many variables pick something that is safer where you can really focus on your breathing and your posture and the

03:01:09 performance all right so that's exercise Choice and then within that if there's some specific thing you want to get better at go ahead do it okay how many different movements meaning should I do the assault bike and then uh some form of safe executable uh overhead pressing um it's a little hard it's a little harder to imagine um Anor robic capacity for the upper body unless you have access to a skier or one of these um what are those things called the climber machines yeah the Versa climber the

03:01:39 Versa climber that's the one the Versa climber um you can tell how often I do that one uh it's a great great piece of excise equipment yeah so how many how many how many exercises and in what order is it going to be two or three exercises since you're involving a lot of muscle groups typically that's a really distinction generally these are going to be total body movements so you can do something like a ski if you want to really isolate your upper body great love that you can do lower body isolation like cycling right where your

03:02:09 upper body's not involved you can use weights here um you can do some barbell movements and and stuff like that they're just not my favorite choice is for most people too many complexity things going on so uh I generally I'm going to pick total body movements uh pushing a sled dragging a sled sprinting up hill swimming these things like that are are going to be good I'm seeing now why the assault bike is such a powerful tool because you're using your arms with some degree of resistance but not a lot

03:02:38 of Eccentric load plus legs some resistance not a lot of Eccentric load and yet one can go quote unquote all out for 30 to 60 seconds yep and the consequences of a technical breakdown are minimal it's more like you're going to actually have a worse performance rather than an injury rate so there just a wonderful invention uh because of that where other things the consequences like say if you're going to be doing a barbell or kettle bell activity the consequences of making a technical mistake you might actually get an acute

03:03:08 injury right there so they're just a little bit higher in the risk scale how many sets are sometimes referred to as repeats so how many 30 to 60c all out sprints again doesn't have to be running sprinting but all out effort would be the better way to phrase it should I perform let's say per week right and then decide whether or not we can divide those up across multiple workouts or whether or not it's better to do them in the same workout yeah if you're staying with the same exercise for all of your

03:03:37 workouts that's a little bit different answer than if you're modifying them so say you're going to do this three times a week and you're going to do an air bike one day you're going to do some Hill Sprints another day and then you're going to do some swimming another day for sake of example I'm going to say um same movement because I think most people are going to be most comfortable with one or two types of movements unless they are really coordinated or an excellent athlete I think most people can probably find a

03:04:04 hill that they could run up yeah and uh an air bike a rower things of that sort yep you're going to have a pro and a con here so the pro of doing less sets is you can actually train much closer to truly 100% the downside is volume's low okay so a major mistake people make here is they'll do something like um I'll do 20 seconds on 10 seconds off and I'll do that for 40 rounds you're not really actually going that hard in those 20 seconds so a key in fact if you look at the literature and all the pros and all the

03:04:41 positive benefits of high-intensity interval training that assumes you are actually hitting very close to 100% if you're sliding down into like again moderate training stuff you start to actually be in a spot where you're not getting the total high-end stuff but you're not doing it long enough to get the low-end stuff either and so you end up in this like you burn some calories you probably still enhanced mitochondria biogenesis and a little bit of capitalization but you didn't really justify only doing

03:05:10 three rounds that's where the problem comes in so in terms of a couple of protocols I'll give you how many sets per week it's it's really hard to give a number unlike the strength training stuff where it was easy to kind of land some stuff on um a typical thing you'll see is like a minimum do tends to be something like four rounds per day three times per week wow that's a lot so my once

a week allout effort of sprinting on the assault bike the so-called airdine bike for 60 seconds one to three rounds of

03:05:45 that might be doing something useful for for me but I should probably be doing that two or three times a week if you're going to get to a max heart rate I generally like to say give me a minimum of one day a week two's better days per week how many rounds whatever it takes you to get to that maximum heart rate right so in your case you did one minute okay good if you're going to extend past a minute or two one round might be enough so for example uh if you want to dis do something where I'm going to run

03:06:14 a mile as fast as I can that's all need to do for the day you don't need to do multiple you can do mile repeats if you'd like but that is really really challenging I know we've extended the time duration here but I wanted to go there to show you the time domain matters here if you're doing something like a 20 second burst you're going to need more rounds if you're doing something longer like multiple minutes you don't need as many rounds to get there so um in addition if you're really reaching past

03:06:44 this um 90 seconds of of hell when it's just going to do a lot more damage to the system not damage is in bad but is in there a lot to recover here so we need more recovery time from that a 20 second burst doesn't really challenge you it challenges in that 20 second ship but you'll be recovered and fine a thre minute thing is going to hurt and it's going to hurt for many many minutes after that and you're going to still see maybe some performance decrements the next day depending on what your recovery

03:07:13 stuff looks like so um a couple of things to playay play with would be something like this if you want to try like a classic 30 seconds on 30 seconds off protocol the literature will show like a minimum of four rounds of that probably three days a week so 30 seconds all out 30 seconds rest is one round repeat that four times at least once a week at least two would be better great right if you want to go something a lot longer than that you might be able to get away with one um but generally two

03:07:43 days a week of this is better if you start actually pushing past like 3 to four days a week up to 5 or six you may actually be causing some problems um there's just a little bit of excess fatigue that's going to happen there that you you maybe want to stay away from in fact you can see a lot of endocrinological problems and some other sleep issues and some other things kick in um and we'll talk about more of those things this later but um that's a number to get with if you want to try something

03:08:10 more like a 20 second burst I actually would recommend giving yourself more rest so you can actually do a higher rest than work ratio most people tend to think of this as doing like one to one 20 seconds on 20 seconds off or lower I love doing like 20 seconds on 40 seconds off the quality of that 20 seconds becomes extraordinarily high and it's also possible to now get like six to eight rounds so as I'm hearing this I'm going to wager a uh an offer uh to you and if you say Okay um than to those

03:08:44 listening based on what you're telling me about the relationship between intensity and quality and the need for sufficient duration of this Anor robic work yeah how is five to six minutes per week of all out work that's pretty good so what that means for me is I would do three allout one minute sprints on one workout separated by a minute or two M maybe more and I would do that two or three times per week just trying to hit that five or six minute per week threshold yep actually I think one of the U Marty gabala is a

03:09:26 scientist um Canadian uh guy who amazing work who's done a lot of the the research on high-intensity interval stuff right and I think the number he actually threw out there in some of his original resarch was comparing six total minutes of work to upwards of like 180 minutes of work throughout um the the entire week and then one of the classic studies was looking at V2 Max improvements and he saw equal if not greater improvements in V2 Max with that so I think actually the name of his book might be like the six

03:09:55 minute workout or something and so you like may have nailed that directly on the head purely by lock but actually by Also may be wrong at that number so we should probably fact check that will and also by inference from what you were saying you know if you're going to do this 20 seconds on 40 seconds off and you're doing more rounds or one minute all out so the way I'm going to think about this if it's okay with you is for five to six minutes a week I am sprinting yeah for my life correct but I'm sprinting for my life with good form

03:10:26 in whatever movement I happen to be doing and I can do all of that in one workout but I'm separating out bouts of 20 seconds all the way up to one minute yep by the necessary rest in order to recover my breathing get back to Pure nasal breathing maybe Zone one zone two totally totally and then hit it again if you're gonna do the one minute thing like you do I actually generally encourage 1 to 3 minutes of rest before you do the next round and probably up to four to six rounds that would be your

03:10:54 six minute number there now the caveat there is we don't worry about heart rate recovery we worry about exactly what you mentioned which is nasal only recovery once you can get back to that give yourself another 30 seconds or so and then you're ready to go for round two this is where it gets fun because I could imagine challenging myself to get on the assault bike for one

minute of kind of warm-up very low intensity each morning and Sprint for a minute and then head off into my daily routine no okay

03:11:24 that if you're going to do that though you need to give me three minutes of nasal only breathing before you go back to work we need to down do that and there are people in my life that would love for me to engage in more nasal breathing because it'll have me speaking less so no problem chances are I'm going to use the um two or three workouts per week of a one minute all out maybe I'll try the shorter protocol can I give you one fun protocol called a try here please so if you have a you can use this

03:11:50 on any equipment um but I learned this from another mutual friend Kenny Kane this is a great little it's a little test a little a little game you can play with yourself and the only way to play this game is you're going to lose which is really really lovely so you can do this at any dur you can do this for any duration of time but two minutes is a good number okay so you have to do this in somewhere where you can know distance so this could be running um the the air bike is what I use the first

03:12:21 two minutes you're going to cover as much distance as you can possibly cover in 2 minutes and you're going to note that so let's say you covered 400 m right okay great you're going to rest for two minutes amazing that next round you're now going to go for distance so you're going to cover the exact same amount of distance you covered in round one which in this example was 400 met and it doesn't matter how long it takes you it may take you 2 minutes and 5 Seconds 2 minutes and 10 seconds because

03:12:55 you're a little bit fatigued from round one round three you're going to now come back and do that exact same time domain that you did on round two so if it took you two minutes and 5 Seconds in round two now round three is going to last 2 minutes and 5 Seconds and you want to see if you can cover a greater distance 405 M 410 M then you did in round one and the beauty of this little protocol six minutes total of work right but if you slack in one of the rounds you just make the next round harder is

03:13:26 there any rest between rounds yeah two minutes always two minutes rest you don't have to but this would be my recommendation Kenny K came up with this yeah I don't know if he came up with it he taught me thing well we both know Kenny and he's an incredibly nice and Incredibly skilled trainer um I'm going to call it the sugar cane yeah it's so great because it sounds really painful and if you go out too hard round one you're in such big trouble round two but if you go too easy in round one you're

03:13:52 going to get absolutely obliterated in round three so it's it's like a wonderful thing and you can pick that number as a standardization and then just try to improve that a little bit per week so progression is the last part of this whole thing that we haven't gotten to yet before we move on um and the way you want to progress all of these things is you can time stamp again how much work you can do and then just try to do a slightly higher amount of work 5% or so every week or you can add a round which

03:14:21 is a really nice way so um uh in the in the research um studies that have been done they're going to do things like week one you'll do three rounds week two you'll do four rounds week three you'll go five rounds you like add a round until you get up to say six or seven or eight rounds at the end of the protocol so that's a really nice way to go about it or you can cap the rounds and just try to get more work done in that same amount of time meaning go more intensely correct yeah you know get further

03:14:48 distance than your 30 seconds or your 45 seconds or whatever um I want to encourage people to go as low as 20 seconds that's going to allow you to go very very very fast that's going to actually challenge that phosphor piece of little bit I want to encourage people to also go as high as 90 seconds so the honest way the way that I will do it not that it's about me but just as an example of something you could do I do something in the 15 to 20 second burst range and I will generally hedge towards

03:15:19 a 2: one rest to work ratio so I'm probably going to rest 40 to 60 seconds that's sure that's to make sure that 20 second burst is extremely high quality cool I'm also going to do something in the 30 to 50 second range okay I might go one: one work rest ratio the quality of those 30 seconds is going to come down but the acid buffering is going to be extraordinarily challenged I'll also will do that with a triple or quadruple rest range so again 30 seconds on maybe 2 minutes off now I won't be able to be I won't be working

03:15:57 on my ability to handle um the waste product build up there but I'll be working on my ability to produce more force over that time which is another skill set and then all the way up to say what you do a minute 70 seconds and you can go one to one there or up to 3 to one um you're going to be working on a little bit of his different thing but that's exactly how he hit both sides of this this equation working on dealing with waste as well as actually working on bringing in nutrients and getting that system a

03:16:23 little bit more effective so um you could set that up across your week and just it could be something like day one is that 22nd burst window day two is that maybe 60-sec window and then day three is maybe one allout effort and we're done there let's talk about the specific protocols and adaptations related to maximum aerobic out put or maximum aerobic capacity as it's

sometimes called sure now we're moving past like that couple of minute range into like the you know five to 15 minute range but at a maximum intensity so

03:17:00 what's the highest you can go from there we're not talking about our last category of long duration here well the beautiful part is we've already explained a lot of it because it's very similar to what we just talked about with anaerobic capacity uh it is primarily going to be a problem of dealing with waste products especially at the end it's not enough total distance to be running out of muscle glycogen though it may start to creep down a little bit Fat's not going to be an issue but certainly more oxygen

03:17:28 transportation is going to be an issue so we're just hedging a little bit more towards that side of the equation towards the end of that workout no doubt about it clearing out waste products is going to be a huge issue but really oxygen demand and delivery is starting to take more of a prominent role because we have had more time to clear waste and if we're not good at that we're going to be failing earlier than we need so the training for that needs to be a little bit at that exact same so a classic

03:18:00 thing here is a one mile test right this is going to last for most people somewhere between 5 and 10 minutes you're sort of right in this window um if you just want to practice that once a week we're done here right exercise Choice same thing we talked about right pick an exercise you're comfortable with with that you can actually do and you can progressively increase in terms of the intensity um you're not going to be you have to stop and change your extra size you're not going to have to move

03:18:27 around it's like a circuit isn't great here because you got to put one Implement down pick up another one you want to be doing something where there is literally not a second of off switch so similar exercise Choice principles we just covered if you going become a real Savage and you want to do repeats here you can um endurance folks will do that a lot one M repeat 800 M repeats things like that or I'm not sure what the swimming distance equivalents would be but swimmers would do this constantly

03:18:54 but you don't need to this is really hard it's pretty hard in the system it's very good for you one to twice a week of hitting this I think you'll be in a really really good spot um frequency we sort of just covered we covered exercise Choice volume we just sort of nailed and intensity is basically running you up to the top there now because you can only do that so often you want to add in another 40 or so% of your time being lower intensity support work for that so this is something probably less than 85%

03:19:25 of your heart rate but higher than quote unquote Zone 2 you got to be working here this is not I could have a conversation Pace this is higher than that it's in between conversation pace and the pace I need to be at to run my fastest mile I've ever done that's that middle ground and you need to train that so that you can continue to work on capitalization oxygen Transportation but you're not burning down the house getting all the way up to 100 100 plus% of your voo Max could I use a uh a crude version of this where I say okay I'm

03:19:58 going to exercise for 10 minutes I'm going to go as fast as I safely can and every week I'm going to measure how far I travel yep easy in that 10 minutes love it probably not on the same day that I'm doing the Anor robic capacity work probably not if probably okay to do after a strength training or hypertrophy workout as long as I didn't train legs you could um it's probably going to compromise recovery is the way so I would if you're going to do a session like this I would probably do it on its own day unless you

03:20:38 wanted to do something like speed or power then you could roll right into this and have no problem maybe a strength day a hypertrophy day I'm not sure um you would do there because again especially if you did any sort of lower body exercise you're going to be compromised here but remember these tend to be full body movements so even if you did arms that day your arms are going to be compromised and you don't want to fail this because of local muscular failure all right so now I've got my work cut out for me I'm going to be

03:21:06 doing five to six minutes per week of all out work divided into 60 20 a 60c bouts with sufficient rest and I'm going to give myself 10 minutes a week of in my case it'll probably be running as fast as I can because I do enjoy running and I can do it safely um maybe uphill and see how far I go yep if you want to combine the two so if you're just saying hey I'm bought in Andy like I want to do both of these things they are similar but they have independent benefits I'm convinced how would I build

03:21:39 these into the same week um maybe do one of each that still gets you at quote unquote two days per week where you're going to hit a maximum heart rate so we already checked that box off so one day can be a shorter length interval repeat one and the other one can simply be a five to 15 minute maximum work and you're done long duration endurance exercise the stereotypical endurance exercise sure how far how long how fast or how slow should rather uh should I go and here I'm going to Venge Ure that

03:22:18 exercise choice is one that we could click off even at this point in the discussion because obviously it's got to be something that I can do for a long while without getting injured uh overuse injuries um there's a little bit of novelty we can actually throw in here so one of the things I love to do for long duration endurance for people who don't love running cycling or swimming is you

can do a really cool workout any number of things where you can put a little circuit together as long as there's not

03:22:47 a lot of downtime between one circuit to the next time you can actually do something as simple as like maybe you're going to do Farmer's carries and you'll do that for say three minutes and you'll set those down and you you'll go straight into a plank for a minute and you'll pick that up and you go straight into maybe body weight squats for two minutes then you go straight into another exercise and you you can sort of rotate things around um maybe you can do even some like Shadow Boxing stuff or

03:23:14 some jump rope you can do gymnastics movements and body weight movements and you can run that thing through and you can basically get the exact same thing accomplished and not feel like you're doing oh my gosh this mind-numbing type of training if it feels like that to you um another way you can do that to actually even simplify it even more um we've done this at Kenny Kane's gym plenty of times where you just maybe even pick three machines so you're going to go I'm going to go 10 minutes on the

03:23:39 rower then I'm going to go 10 minutes on the treadmill and I'm going to go 10 minutes on the bike you can actually knock a 30 minute quote unquote steady state session out in and not feel those problems if those things happen so you can actually have a lot of fun there we will do uh a lot of times with our Fighters we'll do things like put a very low load I'm talking sub 50% of your max on a barbell and you're going to squat and you're going to do you know maybe a minute you're going to put that down and then you're going to

03:24:08 go over and do 50% of a bench press you're going to put that down you're going to go over and do 50% of a crab walk and then and you're going to go over and do another one and you can actually run through this entire thing you don't hit that many reps in any individual movement the load is very very light and you can keep heart rate basically a steady state and do 15 or 20 or 30 different exercises and it's actually like fairly fun and engaging uh to do and it's a little bit more specific than trying to get a 275 pound

03:24:37 NFL player to run for 30 minutes which is not going to be good so I I'm just chuckling because I love to run outdoors and I've enjoyed runs on all my travels and I find it to be a great way to see different places and I like moving through space but there are weather conditions and times when that's not an option so what you described as a terrific alternative I have to assume that the specific adaptation that's occurring here is related to the fat burdening system and again that doesn't necessarily mean fat loss corre overall

03:25:11 but fat burning system and yet I do have a question which is can you build enhanced micro capillary systems into the muscles uh by doing this long duration cardio yeah absolutely you can in fact depending on which paper you uh like more than the other papers um you may even find evidence that this is a superior method than anything else so steady state endurance is very important I used to not like it as much there's just so much evidence now that suggests it's probably a really good thing for basically everybody maybe for

03:25:47 some individuals it's not in all year of their training but if if you're not a high level athlete or have a very specific goal that's right in front of you it's probably best to do at least 20 minutes as a minimum maybe 30 minutes of some steady state exercise once a week for basically any training goal outside of again a couple of really specific scenarios that are happening um the other thing that kind of kicks in here that we haven't really talked about is now actually reaching a position where

03:26:20 fatigue of the intercostal starts to play so diaphragm fatigue starts to run into indication so we forget generally breathing is a contraction to open up the lungs to change pressure so the air will flow in and then the exhalation is passive right it's just a muscle's been stretched it goes back to this resting when you get to a maximum heart rate inhalation and exhalation become active so you're squeezing as hard as you can to open up and you're squeezing to contract to blow air out you're going to get fatigued that system

03:26:49 right over time you have contracted contracted open up if that system starts to get fatigued you start running into failure here so you need to practice that and this is when all kinds of things like breathing drills to just simply training in this fashion um there's all kinds of exercise devices for your lungs and when we say that that's what we're really talking about the musculature around the lungs needs to not fatigue so that's the only other little component I wanted to throw in here if we're not talking about

03:27:17 buffering which in this particular case is not a problem anymore the time domain is long and Slow Earth so we have plenty of time to use fat as a fuel we also have plenty of time to use anaerobic and aerobic glycolysis and clear out waste products so we don't really see pH being a problem with this type of exercise you may start running low on liver glycogen if you're going a very long time muscle glycogen may start getting low but not really these are huge issues you're going to run into Maybe a little bit of

03:27:47 a stroke volume issue but the intensity is not high enough to become a problem you're more likely to break down posturally or breathing mechanics than really anything else unless again that duration really gets generally past two hours for most people so those are the things that are going to limit us so how do we improve it what do we train we went through the exercise choices

you also need to make sure you're training your intercostals we need to be training our diaphragm in some fashion again it

03:28:13 can be the exercise itself can be your normal training the thing you need to be careful of here and this is actually true for all the things we just talked about when we think about fatigue and we think about failure and endurance we really need to pay attention to technical breakdown that is always the marker we look for so when we when we go through our stuff with our athletes and they quote unquote fail or they finish that's generally because we saw a massive technical breakdown you're done like

03:28:42 you're over there it's not always the case during all year round of the training but this is something to really pay attention to so if you're on that bike and you're 40 seconds in and all of a sudden posture starts hunching over I may stop the test I may stop the training it's like no what we decided to failure was is when you lost your Technique to some sufficient level um so you want to pay attention to that too because that's going to determine your ability to perform well as well as maintain efficiency which is a really

03:29:09 big problem here tell me if the protocol I'm about to describe would be a reasonable one for people to incorporate 60 to 120 Minutes of long duration work per week so one way to accomplish that that I often use is to head out for a weight vested hike it's not a heavy weight vest it's maybe I think it's eight or 10 pounds it's one of these thinner ones and if people don't have access to that you can bring a backpack with some items in it I mean it can be as simple external load it can just be your body

03:29:47 that's okay great and and do some hiking at a at a fast enough clip that I'm breathing harder than I would be if I just kind of shuffled along I might stop here or there drink some water no big deal but I can carry on a conversation if I need to so it's Zone 2ish but probably pushing a little bit harder than that for that duration yeah not a lot of um deep soreness occurring after this maybe a little bit of achiness and some stabilization muscles that were used that may not be too much especially

03:30:17 if I've been sitting a lot during the week um kind of reminds me of how much I've been sitting uh but doing that all in one Long Afternoon um typically on a weekend or doing two shorter sessions throughout the week maybe 45 minutes and 45 minutes and then working up the progression to longer longer duration seems like that would be something that most people um should be able to do y and that it would weave in well with any resistance training or the uh anaerobic and aerobic output capacity work that we

03:30:50 talked about just a moment ago great that's a fine version to do it if you want to go shorter and bring up the intensity a little bit so you want to keep it more to the 30 to 60 Minute range and go you know closer into the I can't have a conversation right now but again I'm not at a blistering heart rate um then you could probably get that same thing done in a smaller time window if that was a consideration so if you wanted to blend all three of these together you have a lot of wiggle room right so you could do something

03:31:20 like order if we're talking about this type of training you could do this first and then finish with either one of the higher intensity stuff we talked about so it could be roped into the same thing it could be its own independent day could be your sort of active recovery day it tends to be fairly restorative as you alluded to a little bit there so it's not that big a deal to do this on your quote unquote off day if you're those if you're that type of person who like even on your off day you have to do

03:31:46 something physical this is fine right um if you wanted to do it on a lifting day especially if it's a power or strength day it's probably fine if you wanted to do it before the workout or after either way you're probably okay probably best to do it after if the primary goal is one of the strength training adaptations if it's not if this is the primary goal do it first amazing uh if you wanted to do it in the combination with the other interval stuff you could do it fine there you could do it before or or you could do it

03:32:16 afterwards I actually have no problem doing it afterwards because that in effect especially if you say nasal only during this training will help the down regulation go and so you can finish that fairly well down regulated actually so it's kind of like a nice way to get thoroughly warmed up go really really hard and then give it a nice 20 to 30 minute slow back down and by the time you finish maybe even on a three minute walk nice slow nasal breathing 4 second inhale four second inhale maybe five you

03:32:54 play with the numbers a little bit then maybe you don't even need to do the down regulation breathing afterwards you'll be in a good spot you wouldn't want to do this before do your intervals finish your intervals throw up lay on the ground sweat all over the gym floor get up and go back to work that's probably not our best strategy as people are hearing this all they may be thinking wow this is a lot of work to do but I've been keeping track of the math here I'm sure some some of you out there are as well and

03:33:20 we're really talking about 10 minutes of the of running or sprinting on the bike or rower once a week we're talking about six minutes or so of the much higher intensity but short bouts divided into rounds of 20 to 20 seconds to a minute with with rest in between and then some longer duration workout of 30 minutes minimum but maybe as much as an hour even two hours

which in total doesn't really equate to that much time especially if one can access these things right out their front door or at home and as we pointed out you don't

03:33:52 need any specialized equipment to do that oh and I forgot the um uh muscular endurance I I wasn't trying to cheat there um some muscular endurance thrown in as well so that brings me to a question which is if I'm doing my training for muscular endurance each week for Anor aerobic capacity and for maximum aerobic out output and long duration and given that all of that it's going to take roughly two hours for the typical person total for the entire week which I would argue is going to give you back so much life literally in terms of

03:34:29 longevity you're literally going to earn back years of your life productivity you name it offsetting all sorts of uh metabolic issues and uh enhancing your sleep and and improving mood I mean there's so much data so much data pointing to all those positive benefits if I do all of these things and I'm fairly consistent about them am I going to be metabolically flexible am I going to have a well-developed fat burning carbohydrate burning system and will I be essentially fit I mean this is not leaving aside issues of strength and

03:35:06 hypertrophy which were covered in the previous episode will I be fit I mean to my mind um the ability to you know Sprint very fast if one needs to the ability to go longer duration if one needs to and the ability to do something in between as well as you know hold a box overhead if necessary while installing a shelf or something like that these are the realities of life um and to me represent real functional World Fitness if that's the case is there anything that we would want to add to this program or would you consider

03:35:35 that a fairly comprehensive and complete endurance training system if we remember the target which is I want to have energy I want to look a certain way and you want to be able to do that for the duration of your life for a very long life this style of training where you incorporate all of those areas of endurance gives you all of the necessary adaptations one would need to execute all of those things remember fat loss or weight management is not best done with any individual style of protocol so if you

03:36:11 do a little bit of all three of these you've checked that fat loss box you don't need to go out and do anything separate for it you've done all the things then to cover Aesthetics from that side of the equation right you've done the things to both enhance mitochondria to enhance blood flow increase oxygenation and manage fatigue and waste development boom energy is there fatigue is there I'm not going to get tired or have to quit or stop or sit down doing any of these activi as I want at the same time if you look at the

03:36:43 literature on mortality one of the strong strongest predictors of how long you're going to live is your V2 Max so we've set up a scenario in which you're going to hit all three of those primary goals by doing a combination of this training you're not going to miss any plausible adaptation from endurance training and you should be set for regardless of your goal incredible and as I understand totally compatible with strength and hypertrophy training provided that your goal is to also be strong and also selectively hypertrophy

03:37:18 or generally hypertrophy your muscles or maintain your muscles for many people that are listening to this I'm guessing that they have an interest in building more endurance but not just the ability to go further but the ability to go a given distance at a higher speed and to do it with better form and to breathe better and to feel better before during and after for those folks maybe you could spell out a program that com bins these different elements of endurance and does so in a way that informs how for

03:37:51 instance uh the higher intensity short duration Sprints would be expected to improve their longer duration work and how perhaps their longer duration work um can progress if they are careful to include uh some planks and some wall sits and and things of that sort I ask this question specifically because I have to believe that while there probably are some folks out there that are looking to maximize their plank from week to week typically it seems that people fall into these categories of either wanting to get

03:38:22 stronger and get bigger muscles to varying degrees or to get better at endurance or to get better at everything overall right now I'd really like to just focus on what you think is a nice Contour of a program for the person that wants to get better at endurance but do it with more speed more stability and just feel like a strong endurance Runner cycler swimmer or whatever Happ happen to be their endurance event okay great so let's just give an example maybe you want to run your first half marathon

03:38:53 something like that okay uh maybe done it a couple times before but you want to get better at that time I would probably put somewhere in the neighborhood of 60 to 70% of your you know mileage in the moderate intensity Zone okay so you need to accumulate mileage and you need to be able to handle what we call the tissue tolerance so in this case your feet need to be able to handle 13 miles of pounding okay it doesn't matter how much high heart rate training you do or your fat deliverability none of that matters

03:39:22 if your feet are blown up by mile eight okay so in addition we talked about how even training in that 70 to 85% heart rate zone is quite effective at oxygen delivery fat utilization capitalization Etc so you're going to get a lot of direct endurance benefits from that work you're also going to be working on what's honestly going to be one of your limiting factors which is that tissue

tolerance and that pounding okay in addition you need to be efficient with your Technique and you need a lot of repetitions for motor skill development

03:39:54 so you want to spend most of your time there it's easy to recover from it's not extremely um demanding and challenging awesome that leaves you with another 30 or 40% of training I would spend 10% of that in that like 20 second burst area you're going to drive up fatigue extremely high and you're going to really maximize your ability to recover from um waste production all right great I would spend the remaining amount of time either on a little bit of actually maximum speed stuff that could actually

03:40:26 be in the 202 burst if you're really trying to go as fast as you can at the beginning of that exercise and then the rest of it I would spend in that other Zone which is more of like the five to 15 minutes but you're probably going to want to repeat those and this is when things like 800 meter run rest for double the time and then repeat that two or three times you actually need that in this scenario because you're going to need to be able to be running for two most people are going to do half marathon in maybe around two hours or so

03:40:56 something like that and so you want a little bit of what we call repeated endurance right so be able to handle that higher heart rate come back down do it again at the same time that's actually how you bump your mileage up so instead of having just do more of these long duration distance runs you can still get maybe five or six miles done in a day if you're going to do a one mile repeat or whatever number you're looking at so for a lot of people that's kind of how I would structure it um that's honestly is very similar to what

03:41:26 we laid out in the previous conversation which is getting to this idea that more than 50% should be basically practice a little bit of work at the very top end of the spectrum but not too much and then a little bit of work at the other end and you should be in a good spot a major mistake one would make here is only doing the long duration steady state stuff and just sort of saying say I'm going to run five miles this week and then do six miles next week and seven it might work for you it's I think

03:41:52 we have enough evidence at this point both in the scientific realm as well as most of the coaches I think in this space would agree with me is that's a suboptimal strategy so it could work but we can do better and in terms of the structure of a program like this I realize that those structures vary tremendously different coaches and different books and different programs are going to say oh you should run Monday through Friday with weekends off or every other day but in terms of this 70% um 30% divide where 70% is going

03:42:21 toward the specific event you know doing the kind of work that you're going to do during the specific event that you're most interested in cultivating or improving and the remaining 30% coming from other sorts of uh of supporting uh work how should one think about Distributing that other 30% should it be all geared towards maximizing recovery for the 70% or in other words um could I do all that 30% work on one day I probably would split it into two days um that's the reality it is so if you're thinking man coach wants me to train six

03:42:56 days a week my schedule is tight I can pull off four to five okay great what I might say is two of those days are just your your tempo right this is what like a runner would call this like Tempo training um kind of in that space remind us what tempo training is just to 80% effort range where you're like running at probably the same stride length and and rate that you're going to run your race at maybe a little bit lower but something similar your practicing skill you're acing mileage and you're getting a little you're

03:43:26 getting work and for sure work but it's not absolutely the fastest you can Sprint it's also not conversation so this would be the um what before we referred to as the 10 minutes of of fast running or 10 minutes of fast R this is lower intensity than that got it this is um this is work accumulation got it this is practice St um then one of the days a week I would probably enter in that 202 30 second burst for a little bit of speed there and then one of the other days is when I would do that true high intensity as hard as I

03:44:00 can for hitting a VO2 max something like that so that's probably how I'd break it up if I had like four days a week if you had five you can maybe add in another day where you do more of that uh volume accumulation practice work um but that's that's a pretty good well this is the point in the episode where I say thank you ever so much you provided an enormous amount of incredibly interesting clear information that's also actionable I do feel as if I far better understand endurance in its many forms and even the Sellar

03:44:35 underpinnings of that and even subcellular underpinnings of what endurance adaptations are and how to Foster those through specific protocols things that not only I can do tomorrow but that I will do tomorrow and where I hit my pain points I'll understand what's happening and the adaptation that I'm triggering when my legs are burning or I'm sucking for air through my mouth or I can calmly move along just through nasal breathing I will now know what's happening in my body and the specific adaptations that

03:45:02 I'm triggering I think you also highlight something that is vitally important and I've never heard it phrased as clearly as you did today which is that it really doesn't matter how one seeks out to achieve fat loss provided certain criteria are met even while certain forms of exercise tap into fat stores more than others and you beautifully Illustrated the relationship between energy

utilization and breathing and the fact that we literally exhale fat to to some extent of course so once again thank you thank

03:45:36 you and thank you I know I'm not alone in um recognizing this information as incredibly interesting and and actionable and indeed I do plan to put it into action as I I hope many of our listeners will as well yet again the pleasure is actually all mine and uh I actually really appreciate the fact that you let me go so far into metabolism my PhD is in human bioenergetics so anytime I can go many hours into metabolism I get very excited and I don't typically get that leash um in this format so I appreciate that I know you understand

03:46:08 your audience will love that hopefully oh they they'll love it and I think that they'll especially love it because they understand that if one can wrap their head around even just a small fraction of the mechanisms that underly a given protocol it gives both tremendous depth and meaning to that protocol and makes it so much more flexible for people they can really think about what's happening as they're engaging in a given protocol and know exactly what they can expect in terms of results Great we've been on a bit of a

03:46:37 journey here we've covered a lot of ground with speed development and strength and hypertrophy and now we walk through you know probably several hours here of endurance what I would love to do next is to just give you a more straightforward not as much background not as much metabolism none of the mechanisms right into protocols for someone who says look I want to hit those marks you keep talking about I want to look good I want to feel good and I want to do that across my lifespan how would I build all these things into

03:47:10 a protocol that actually covers maybe the entire year and how what I would be able to repeat that year after year so I almost have this Evergreen sustainable year-long periodization structure that covers all the nodes I need to if I want everything we've talked about in these nine adaptations in this short Series so I would love to do that in our next conversation if you're learning from Andor enjoying this podcast please subscribe to our YouTube channel that's a terrific zero cost way to support us

03:47:39 in addition please subscribe to the podcast on Spotify and apple and on both Spotify and apple you you can leave us up to a five-star review if you have questions for us or comments or suggestions about topics you'd like us to cover or guests you'd like me to include on the hubman Lab podcast please put those in the comment section on YouTube we do read all the comments please also check out the sponsors mentioned at the beginning and during today's episode that's the best way to support this podcast I'd also like to

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03:48:31 cost by going to hubman lab.com you can also go into the menu tab and go to newsletter and see some example newsletters from months past thank you once again for joining me for today's discussion about fitness exercise and performance with Dr Andy Galpin and as always thank you for your interest in science [Music]

00:00:00 ANDREW HUBERMAN: Welcome to the Huberman Lab Guest Series, where I and an expert guest discuss science and science based tools for everyday life. [MUSIC PLAYING] I'm Andrew Huberman and I'm a professor of neurobiology and ophthalmology at Stanford School of Medicine. Today's episode marks the fourth in the six episode series on fitness, exercise, and performance. And today's episode is all about optimal fitness programming, that is how to design a fitness and exercise program that can achieve the goals that you want for fitness and for sports

00:00:30 performance. Dr. Andy Galpin, great to be back. In previous episodes, you taught us about the various adaptations that occur at the level of cells, at the level of organs, indeed at the level of the entire body that underlie things like improvements and strength and speed, hypertrophy, AKA muscle growth, and the various forms of endurance. And you laid out beautifully the various protocols that one can do in order to achieve each and every one of those adaptations. Today I would love for you to teach us

00:00:59 how we can combine different protocols to achieve multiple adaptations in parallel - for instance, how to improve endurance and strength, how to achieve some level of hypertrophy, perhaps directed hypertrophy at specific muscle groups, while also maintaining endurance and perhaps improving speed, for instance. And if you would, I'd love for you to tell us how we can combine different protocols and vary those across the week, across the month, across the year so that we can make regular progress

00:01:29 and perhaps even could give us a window into the ways to make the fastest progress possible. ANDY GALPIN: Yeah, I would love to do that. We've invested a lot of time in the previous episodes covering background and concepts and detail about the physiology so you understood why you're making the choices you're making and why other choices are less effective. In this discussion, I would actually like to jump maybe more directly to the answer and kind of get right into the protocol and maybe a little bit less background.

00:01:59 If you're interested in that stuff, I suppose you have to go backwards a little bit and watch some of those previous episodes. But I would love to jump in to just some samples, some case studies, if you will, and kind of walk through different protocols. I know that over the course of my 11 years as a college professor and being in the public space a little bit, probably the most numerous style of question I have gotten is exactly that. So I know the rep range for this, or I know the style of training for that adaptation.

00:02:29 But how do I put them together? And I would just like to spend our time today going through those things. And the reason I want to do it is this. Some people listening at home surely just love exercise. They're already bought in. And they're going to train no matter what. And they're interested in just actually being more effective. And so the way that you structure and put your plan together will in large part determine getting more progress for less effort or actually being able to put the same amount of effort in

00:02:59 and getting results faster. There's also some folks probably listening who are like, OK, I exercise. I do what I can. I'm bought into the benefits that you've talked so elaborately over the 100 plus episodes you've done about the various benefits of exercise. But you don't like-- you're kind of doing it because you know it's important. But you're not there. So for those folks, it's sort of like, OK, how can we actually make this thing more effective so we can make sure you hit the things you're

00:03:28 absolutely have to get for the short and long term benefits to make sure that you're looking the way you want to look, you're performing physically the way you want to perform, and that you can do that across your lifespan? So how can we give you all some structure to where, again, you don't have to turn into an absolute lover of physical fitness and it doesn't have to take over your life but you can still get more results for your same time restrictions, whether that be two days a week or five days a week or only certain access

00:03:57 to equipment or experience, whatever the case may be? How can we help those folks as well put together a protocol that will get them closer to their goals with less restrictions? ANDREW HUBERMAN: Fantastic. And I'm hoping that along the way, you'll also point us to how often to take the fitness assessment for each of the adaptations that you referred to in a previous episode. We will also link to that fitness assessment segment in the show note captions for this episode because that fitness assessment for different adaptations,

00:04:26 I think, is a really powerful way for people to touch in and see how much long endurance do they have, how much anaerobic capacity do they have, how much strength do they really have. And then perhaps you'd also be willing to throw in a couple of additional ways that we can assess our level of fitness and progress in this arc of fitness program across the year. ANDY

GALPIN: Amazing. I can't wait to do that. I think it is also important before we jump in to acknowledge a lot of folks may be thinking to themselves,

00:04:56 I don't really necessarily need a plan. Why do I have to do that? I don't have a certain goal I'm going after. I'm not running a race any time soon. I'm not a competitive athlete. I just-- I go to the gym, and I workout. And that's great. Well, I would like to try to convince you that regardless of where you're at, having a plan will achieve those things we just talked about, which is more success in a shorter time frame. There's actually a significant amount of research to support this. Those individuals who go on a specific training plan

00:05:22 compared to those who do not will receive better results independent of the effectiveness of the program. So we've talked in previous episodes about tons of different styles and strategies. And to reiterate, it really doesn't matter which one you pick. The fact that you have a plan is always more effective than not having a plan. And so, again, even if you're not planning on competing with something, if you want to shorten the amount of time you're in the gym, get more results from it, I would strongly encourage to put something together.

00:05:56 The two largest reasons why people don't get results with their fitness training protocol is number one, adherence, and then number two, some sort of progressive overload. Both of those two things are challenging to accomplish without a plan. So the reason people don't go to the gym, one of them, and one of the reasons why it takes them so long is because they don't walk in with a very specific plan. It's sort of like going to the grocery store and figuring out what you're going to buy versus knowing exactly what you're

00:06:24 going to get in your shopping list, grabbing those things, and getting out. You'll notice your time in the grocery store is half the length. You're more productive. And you didn't waste money on extra things. So that alone will drive adherence because you're now going to think to yourself, oh, that 90-minute workout I do is actually really just 60. And so now the next time you go to training you're like, man, I don't have 90 minutes. You realize it's only 60 or 40 or 30 or 20 or whatever it needs to be.

00:06:44 So that alone will get you there. The second part of that which is overload. It's very difficult to understand and remember, well, the last time I did lat raises, I used I think 5 pounds. And I think I did like 12. Well, if you don't have some sort of system of tracking-- and this can be as simple as a notebook, just writing down what you did before and doing a little bit more the next time. That is going to almost guarantee you success. So having some structure-- and this structure can be fairly

00:07:11 loose, so we're going to talk about a bunch of different examples-- is something I strongly encourage everyone to utilize for their exercise. ANDREW HUBERMAN: Before we begin, I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford. It is also separate from Dr. Andy Galpin's teaching and research roles at Cal State Fullerton. It is, however, part of our desire and effort to bring zero cost to consumer information about science and science-related tools

00:07:35 to the general public. In keeping with that theme, we'd like to thank the sponsors of today's podcast. Our first sponsor is Momentous. Momentous make supplements of the absolute highest quality. The Huberman Lab podcast is proud to be partnering with Momentous for several important reasons. First of all, as I mentioned, their supplements are of extremely high quality. Second of all, their supplements are generally in single ingredient formulations. If you're going to develop a supplementation protocol,

00:08:00 you're going to want to focus mainly on using single ingredient formulations. With single ingredient formulations, you can devise the most logical and effective and cost effective supplementation regimen for your goals. In addition, Momentous supplements ship internationally. And this is, of course, important because we realize that many of the Huberman Lab podcast listeners reside outside the United States. If you'd like to try the various supplements mentioned on the Huberman Lab podcast, in particular supplements

00:08:24 for hormone health, for sleep optimization, for focus, as well as a number of other things, including exercise recovery, you can go to livemomentous-- spelled O-U-S-- so that's livemomentous.com/huberman. Today's episode is also brought to us by Eight Sleep. Eight sleep makes smart mattress covers with cooling, heating, and sleep tracking capacity. I've been using an Eight Sleep mattress cover for about the last eight months. And it has completely transformed my sleep. I'm sleeping about the same amount.

00:08:50 But I'm sleeping far deeper. And I'm now getting the proper ratios of so-called Rapid Eye Movement or REM sleep and slow wave sleep and waking up feeling far more recovered mentally and physically. The underlying mechanism for all that is very straightforward. I've talked many times before on this podcast and elsewhere about the critical relationship between sleep and body temperature. That is, in order to fall asleep at night, your body needs to drop by about 1 to 3 degrees in terms of core body temperature.

00:09:15 And waking up involves a 1 to 3 degree increase in core body temperature. With Eight Sleep mattress covers, you can adjust the temperature of your sleeping environment to be one temperature at the start of the night, a different temperature in the middle of the night, and a different temperature as you approach morning, each of which can place you into the optimal

stages of sleep and have you waking up feeling more refreshed than ever. If you'd like to try Eight Sleep, you can go to eightsleep.com/huberman

00:09:39 and check out their Pod 3 cover and save \$150 at checkout. Eight Sleep currently ships in the USA, Canada, United Kingdom, select countries in the EU, and Australia. Again, that's eightsleep.com/huberman to save \$150 at checkout. So what sorts of things should people be thinking about when developing an overall fitness program? ANDY GALPIN: A few minutes ago, we were talking about how two of the major reasons people don't get as much out of their training programs as they would like is because of one, a lack of adherence,

00:10:10 and two, a lack of progressive overload. So the solution to that is constructing a plan that lives within your realistic limitations. So I would like to walk you through my 10-step approach to how I design training programs. Now, before I do that, I think it is fair and important for the audience to understand that this is simply my approach. I've been doing this a long time. I played college football. And I wrote my own training programs back then. I have and am still working with professional athletes

00:10:40 in the PGA TOUR and the NFL, the NBA, Major League Baseball, as well as a ton of general population folks. So this is a combination of the evidence base that we've been talking about in terms of best practices for strength and conditioning as well as just my years of experience. So there are many, many ways one could do this. I'm not even suggesting this is the best. This is simply how I do it. This is exactly how I handle it when a new individual comes to me and how I teach my students. So step number one is assessing properly and identifying

00:11:11 a training goal. Now, that's actually sort of funny because we hear that a lot. But a lot of people actually never take that step, not to call anybody in the room out. ANDREW HUBERMAN: But what's happening here is this morning Andy, Dr. Galpin, and I were training together. And he was providing amazing tips on form and set rep cadence and the sort of thing. And he said, so what's your training goal for the next 12 months? And I paused. And it turned into a very long pause because-- ANDY GALPIN: Which is an nice way

00:11:43 of saying he didn't have an answer. ANDREW HUBERMAN: I didn't have an answer. Of course, I don't just want to maintain what I've developed in terms of strength and hypertrophy and endurance. But I don't have a clear goal. So I'm hoping that by the end of today's discussion, I will be on track to a clear set of goals. ANDY GALPIN: Amazing. I'm not going to bore you all here. But, really, I can't stress enough how important that step really truly is to getting results. The analogy we use here is if you left your house

00:12:14 and you were attempting to get to the grocery store and you just started driving and if you drove every possible route, you would eventually get to a grocery store. And so, yes, that can work. A better approach is saying, here's where I am. There's where I want to go. What is the optimal route there? And that's really what you're doing with goal. So it is a boring setup. It is not interesting to hear. I don't have any real hacks or tricks for you. But it is step number one on purpose. We have to know exactly where we're going.

00:12:46 You can do this in two ways. Way number one is to just pick something. Arbitrarily decide I'm going to run a 5K. Or I've done that before, and I want to improve it by 10 seconds. I want to lose 10 pounds. You can just pick one. That's great. Another way is to run through that fitness testing protocol we described a few episodes before. And if you do that, you can see which of these areas that maybe you have the largest lagging in. Or what is the most severe performance anchor is how we refer to it.

00:13:15 And then choose that as your primary goal. So either option. Some people come in to training programs with a very clear goal in mind. They want to add more muscle or whatever, whatever. OK, great. If you're like, I don't really know, I just kind of work out, then run the fitness testing protocol. You'll see what score is the lowest end. And then you'll maybe make that a priority for the next, say, three months. ANDREW HUBERMAN: So the first step is to identify a specific or set of specific training goals.

00:13:43 ANDY GALPIN: A really nice tool for helping you set a goal is a system called SMART. Right now there's a little bit of debate on what those acronyms actually stand for. But we'll get close enough. So SMART is often Specific, Measurable, Attainable, Realistic, and Timely. So starting off with S, specific, in general the more specific your goal is, the higher likelihood you will have at succeeding in that. M, being measurable, means it needs to be something that you can actually put a metric on. So this can be objective or subjective.

00:14:19 But, generally, I like to have at least one objective measure. So remembering objective is something that is not based on feeling. It is not up to you. This could be something simple like your body weight. It could be how much you can bench press, what's your 1 mile time, whatever is most important to you. It actually doesn't have to be a fitness related goal. For example, if you're using fitness as a way to enhance your sleep, the main metric you may be interested in is amount of hours slept. It could be something like efficiency

00:14:49 or whatever is most interesting. It could be work productivity. It doesn't really matter. So it doesn't have to actually be the fitness goal. But what is the motivation of why you're doing it? So that's specific, measurable. Attainable or actionable, as is often described, is something that is within your capability. So attainable-- a bad example of attainable is something like, my goal is to

win more games. That may not be up to you. The other team you're playing, it could influence it, the schedule, et cetera.

00:15:20 So attainable should be something that is within your control. Realistic or relevant to you is something that is, again, something realistic that you can achieve. You wouldn't want to make a goal that is you want to double your body mass. That is not going to happen. So think about the constraints. How old are you? What's your training experience? How much time do you really have to invest in this? And then pick something that is realistic. And then, honestly, my little twist here is take that in minus 10%.

00:15:48 Because, typically, when people put together training programs, their goal tends to be quite lofty. And they get some small percentage of the way and realize they're never going to get there and then back off. We actually-- this sort of reminds me of a classic deception study that we did in my lab one time, where we took people and we had them do this maximal front raise. Basically, you held a dumbbell out in front of you for as long as you possibly could. And the goal here was actually-- it's a deception study.

00:16:17 So we're tricking them. And so we said, OK, we want to just get normative values to see how long people can hold this front raise. And I think we use something like 5% of their body weight. And so they came in. And they did it one time. And we timed them. They didn't get to see the clock. They left. And then we said, we've got to come back in and repeat it. We got to do a couple of tries here to get a normal value in case it's off, whatever. Well, the participants were split up into four groups.

00:16:41 So group one actually was told that their time was 15% lower than they actually got. Group two was 5% lower. Group three was 5% higher. And group four was 15% higher. So the second time they came in to do it, our graduate student, quote unquote, "made a mistake" and left the timer in front of them. So the first time again they did the exercise, they're just holding it. They don't have any idea how long they're holding it. The second time, they had a giant iPad set like just a little bit off centered

00:17:11 where they can clearly see it. So they watched the time go by. And, of course, what happened was those folks, say, who did 1 minute the very first time when they tested, they came back in to do the second time. And they're holding it. And we told them they actually got 45 seconds, when in reality they had done a minute. So they're holding it and holding it. And they think they only did 45 seconds. By the time they get to like second 40, 41, 42, they get past 45. They almost all quit, like 47, 48 seconds,

00:17:43 because they wanted to beat their previous score but then were like, cool, I beat it. And then they quit early. So they were actually not yet to failure. But they were just happy enough to beat what they thought they'd done. And then they quit. The other group on the inverse side-- again, say they got a minute. We told them they got a minute and 15 seconds. They got to like 45 seconds, 50 seconds and started realizing, oh, man, I have 30 more seconds to go. And they quit way early because the carrot was way too far out.

00:18:12 They realized I'm never going to get there. So I'm just going to stop now. Can you guess which group did the best on the post-test? ANDREW HUBERMAN: The ones that were just within about 5% of. ANDY GALPIN: Totally. So they wanted to improve. And so, again, say, they got a minute the first time. We told them they got a minute 5-- or, sorry, they got a minute 5 the first time. We told them they only got a minute. They actually exceeded that greatly because they wanted the PR. So making sure that goal is properly aligned,

00:18:42 it needs to be a little bit scary, a little bit unrealistic. You're going to have to work for this. If it's too easy, you'll quit. You won't feel like a challenge. If it's too hard, though, you'll quit early as well. So you want to make sure it's that reasonable balance of, ah, should I train today? Or like maybe I'll just go through-- if I do that, I'm not going to hit. I got to get after it. But not like, oh my God, like, there's just no chance here. So you're going to walk away early. ANDREW HUBERMAN: That's a fantastic study, I have to say.

00:19:13 It's very simple. I think it illustrates a number of important psychological principles about goal setting, motivation, self perception, but also the dopamine system. The dopamine system is this universal reward system that-- meaning it doesn't only work for food or only work for fitness goals or only work for academic goals or relationship goals. It is the universal substrate for all of that. And I actually think there are some real gems of information in that study design that you describe. So just cue that for maybe a potential collaboration

00:19:49 between our laboratories because-- ANDY GALPIN: Yeah, absolutely. ANDREW HUBERMAN: --I think it's very important. But it does cue up another question relevant to fitness. In particular, which is what are your thoughts on intermediate goals? So let's say my goal is to drop 2% of body fat from where I am now a year from now. So roll into the next year from now about 2% lower on body fat but maintain my lean body mass or maybe even increase it. How should I assess progress? Because the dopamine system loves a goal.

00:20:30 It loves anticipation of a goal. But it responds best to, we sort of re-up, if you will, our dopamine any time we get a signal that we are on the right track to that goal. And that signal could be, OK, I did the workout. I just trust that these workouts are going to give me the result I want. But, of course, we know that when people get a glimmer of the idea or some objective feedback that

they're on the right path, that dopamine system really fires and provides motivation for continuing toward the ultimate goal.

00:21:02 And as we've talked about in the strength, speed, and hypertrophy episode, resistance training itself has this built into it because of the infusion of blood into the muscles. You actually get a little window into what you might get in terms of an adaptation simply by way of the so-called pump, whereas endurance type work generally doesn't have that. You don't see yourself get better drop back and then adapting to actually get better. But that's actually what you see with weight training. So given all of that contour of the dopamine system, what

00:21:32 sorts of intermediate goals should I set for myself or should somebody set for themselves? And I realize it will probably depend on the ultimate goal. But would you say check in on progress once every week, every month, three months? ANDY GALPIN: I don't know if you can tell the look on my face. I love this question and this topic. I spend so much time on my senior and graduate level program design course. I've been fortunate to work with a few athletes where we've had multiple years. And if you can really take the time to step back and go--

00:22:06 it's not about optimizing for the next six weeks. And in this case, it's not the next fight. It is the championship fight that we need to get to in three years. Or it is the Olympics, which are on a quad program. You're really optimizing for that for a year. If you can have that foresight and really think about that and then work backwards, you can see some pretty tremendous things. The sort of saying that is we tend to overestimate what we can get done in a week and underestimate what can happen in a year.

00:22:36 That can be extraordinarily powerful. However, you have to have those metrics called out ahead of time because you will lose motivation in that short term because you won't see that result immediately. But if you remember, I'm on a path to 4% or 2% or whatever you need to be, therefore, I only need to be this far right now. I need to be that far and then that far. It's actually quite clear. And so what we would actually do in that scenario, not to go so off track here because I can really go on this stuff, is--

00:23:05 let's say it was the year recommendation. You're going to actually need to go to the last part of SMART, which is timely. So part of setting this goal is making sure you understand the time domain responsible. And it's actually quite great here because, not to go Inception on us, where we're like list within a list, and Rob kills us over here. But number one of this program design thing was assessing your goal. Number two is identifying your defender. What I mean by that is, what is stopping you

00:23:35 from hitting that goal? So you want to lose 2% body fat in the next year. OK, great. What's going to stop us? Once we can achieve that, and we'll go into more of that in a second, then you just start walking that 2% backwards. So you might have to go something like this. Look, every time I start working out really hard, I always get hurt. Interesting. OK, great. So maybe instead of jumping really hard into a high intensity interval training program, knowing we're likely to hurt something or get burnt out

00:24:10 or quit or whatever the defender is for you, maybe we invest something right now, which is maybe improving your flexibility or working on movement technique, whatever is going to stop you from getting hurt. Or maybe we progress slower so we don't get there. That will allow us to do the work necessary to hit that goal 12 months from now, not two weeks from now, not two months from now. Maybe that's not the case. Maybe you're like, no, look, hey, I move well. I feel like I'm in decent shape. I've got enough muscle mass on me.

00:24:38 We've talked in previous episodes why having insufficient muscle mass is sometimes detrimental for fat loss. So you checked all that boxes. I don't get hurt very often. I got equipment around, no problem. I've got the time in my schedule. And I have enough muscle. Great. Well, now we maybe just split it up and say, look, we got 12 months. We got 2%. It's as simple as doing half a percent per quarter of the year. And now all we're looking at is that number. I don't have to necessarily get all these things done.

00:25:08 I can go a quarter, half percent, half percent, half percent, half percent. You're going to get there. The other scenario that I laid out a second ago, it maybe needs to look like something like this. Quarter one is going to be 0%. Well, yeah, that's right, you may not lose a pound for the next three months. We don't care. That's not the goal of these treatments. I know that's the goal this year. That's our major macro cycle goal. We're going to get there. But to get there most effectively, we need to invest in working more with your chiropractor

00:25:40 or whatever the thing is. That will allow us to then go half a percent quarter two, when we can really start training. But we're going to ramp into it. Quarter three we're going to go another half a percent. And now we're halfway there. Quarter four, we've invested so much you're ready to go. We're going to go hard. We're going to get that last 1%, that last quarter. And we're going to get there. And you won't be hurt. ANDREW HUBERMAN: So that makes it very clear. And I can also envision how the precise structure

00:26:07 of these intermediate goals would vary depending on what sort of adaptation one is pursuing. And I do remember from our previous episodes that fat loss itself is not an adaptation. It is a byproduct of other adaptations. So I just want to make sure that you know that I was paying attention. It's committed to memory. ANDY GALPIN: Absolutely. ANDREW HUBERMAN: Some

goals, such as fat loss, are very quantifiable. And yet, they might not be linear. It's hard to know-- the assumption is if you ingest x fewer calories than

00:26:38 are required per day, then you'll lose x amount of weight, some percentage from body fat. I think that cues up the idea that we need to build some flexibility into our thinking about these intermediate goals in order to just make sure that dopamine system isn't tethered to exact numbers because after all a reduction in 2% body fat, for instance, is really a desire to achieve a different sort of overall body composition or recomposition. I don't know, by the way, that that's my exact goal. I think one of my goals is to be able to run a mile faster.

00:27:12 And I'm sort of haunted by this experience of wanting to run cross-country in college and trying to walk on. We weren't a Division I school. But the threshold for being considered for the team was you had to run a sub 10-minute 2 mile, which turns out to be very, very fast. ANDY GALPIN: That's really hard. ANDREW HUBERMAN: I did not do that. I didn't even come close. And I don't think that I could reasonably do that now. I'm not interested in committing to the kind of training required. The sacrifice isn't meaningful enough for me.

00:27:47 ANDY GALPIN: Fair and honest. ANDREW HUBERMAN: But lowering one's time to run a mile by, I don't know, 10% seems like a reasonable goal across six months. ANDY GALPIN: Sure. ANDREW HUBERMAN: Great. So in the case of a goal like that, clearly there are specific training programs. But this raises the issue of, what if I have other goals as well? And at what point do people having multiple goals start to set up collisions between goals? How do we know whether or not something is reasonable not just on its own but because of the other things that one

00:28:22 has structured into their program. So being able to reduce a mile time by 10% in six months, OK, maybe that's doable. Maybe it's not. You can tell me. But also being able to double the amount that they can do for single repetition leg extension for that matter, at the same time those seem like incompatible goals. ANDY GALPIN: So a couple of things. Number one, the more specific and precise you can be with a single goal, the faster you will get there, generally. So in theory, if you had one thing you wanted to achieve,

00:29:02 the best way to go about it is to focus on that. Give it the most priority. That doesn't mean you can't do anything else along the way. You can. But you would want to focus on that. The more additional goals you bring in, the more distraction you're creating for that primary goal. Depending on what those goals are, you can actually do them at the same time. Some other combinations are less effective. Think about it like this. We went through those nine adaptations. And we went through them in a specific order on purpose.

00:29:30 The closer those adaptations are together in that list, the more compatible they are to training each other. The further away, they become more challenging. So just to give a few examples. If you wanted to improve your speed in power, you could basically train those simultaneously. They would not interfere with each other at all. And, in fact, since power is speed times force, it would be complementary. If you just walk down the line from there to strength, hey, same thing. If you get faster, that's going to aid in strength

00:30:00 because force is mass times acceleration. So if you improve acceleration, you're contributing to strength. Same thing with power. So speed, power, and strength are generally very complementary. You can absolutely train all three of those goals at the same time and have no issues. Getting into hypertrophy, now we've got a little bit of distinction. If you're going to train strength and hypertrophy, as we talked about in that episode, at the base those are going to be complementary. You add on some muscle.

00:30:30 You're going to get stronger. You start training for strength. It's probably going to help you out on some muscle mass. As you get to the end of that spectrum, the overlap between the two starts to go away, such that if you truly wanted to maximize strength above everything else, if you continue to train for hypertrophy as well, that's going to take too many resources out of your recovery bin. And you won't be able to do that. The inverse would also be the same. If you're training to maximize strength,

00:30:57 you wouldn't be able to put enough volume on to get sufficient hypertrophy. So if you wanted to then combine speed with hypertrophy, you're going farther away from each other, which means it's going to be more and more distraction. So the hypertrophy training would cause a ton of fatigue. You wouldn't be able to go at max speed for your speed or power strength. So you're going to be compromising those results. Now, speed training won't compromise your hypertrophy training because it's non fatiguing.

00:31:26 And so, boom, here we have a little bit of an interference effect one way but probably not the other. Let's move down the spectrum one more time and get into endurance. We won't go through all of these things. But you're getting the idea here. Oh, a little bit of high intensity intervals? OK, cool. Now, would that compromise my speed, power, or strength? Probably because there's a little bit of residual fatigue. If the volume was low enough, then you'd be fine. All you're worried about there is not necessarily

00:31:55 like some sort of cellular mechanism. It's just simple fatigue. It is amount of energy expenditure versus is that compromising my recovery to come back. Would those first three or four of those-- speed, power, strength-- interfere with your ability to elevate your anaerobic capacity? Probably not. Almost surely, in fact, if you look at any of the literature on endurance training, you will

see that speed, power, and strength almost always improve endurance. Endurance training added on top of strength can be detrimental,

00:32:31 can have a neutral effect, but generally doesn't help one get stronger by adding additional conditioning unless you're so unfit you can't get through the volume needed in the strength training. One more example here so we don't drag this out too far. In the case of something like I want to lose fat, well, hey, we don't have to worry about interference. It doesn't really matter. If you're fatigued for your hypertrophy session, not a big deal. We're just trying to get some work done. If your hypertrophy session fatigued you

00:33:03 from your conditioning, it's cool because you got the work done. So you don't have to worry about it so much. So it really kind of depends on the actual goal. And what you want to pay attention to is, actually, what are the chances of overlap, which means like what are the adaptations you get physiologically that cross over from one to the other? And then what are the ones that are actually going to start interfering? In fact, in my class, I have this giant matrix chart of interference effect going from adaptations

00:33:31 through a whole bunch of systems, everything from handling pH to lymphatic drainage to bone marrow density, et cetera. You can walk through these whole things and see which ones actually have a positive effect, which ones have a massive positive effect, and then which ones actually have a little bit of an interference. And perhaps if you guys are nice enough, we could throw that into a newsletter or something, some PDF or something. ANDREW HUBERMAN: I think that would be immensely valuable. I think some of that more extensive information,

00:33:59 when it's laid out in grid form like that is really useful. So we should-- well, now we've said it. So we-- ANDY GALPIN: I didn't say I would do it. I said perhaps. ANDREW HUBERMAN: I think it's a great idea. I think it's a terrific idea. The idea that items closer to each other on the list of those nine different adaptations are going to be easier to achieve in parallel than items further apart makes perfect sense. And what I heard was that there's a few caveats that might seem minor. But they're actually quite important,

00:34:33 such as anything that is relatively low intensity and doesn't impede recovery can probably be included as a parallel goal. So some speed work in conjunction with some long duration cardio work, versus even though we're talking about number 2 on that list and number 9 on that list. ANDY GALPIN: In that case, the long duration endurance, even if it's low intensity, may actually interfere with the speed if the volume gets too high. If you're talking about, I went on a 30 minute jog, for most people, it's totally fine.

00:35:03 What we're really talking about here is when the miles start piling up. And the time really starts getting there in combination with some of the things-- the factors we've talked about earlier, which is exercise choice. So more eccentric landing based exercise choices. Running, for example, is more likely to interfere than cycling because you're not landing. Swimming is low impact. So if you're going to do those things, you can hedge your bets a little bit by choosing an exercise choice that is less impactful.

00:35:31 Again, if we're literally-- because there's oftentimes confusing here is like, oh, don't do 10 minutes on the treadmill before you lift. You're going to cut-- oh, time out. Warm up is fine. We're really talking about probably more than 30 plus minutes at higher than 60% heart rate-- random number, something like that, depends on the person, et cetera. But it has to be a decent chunk. Again, you can actually fix that by then just consuming calories. You can also fix that by making sure everything

00:36:02 else in the hidden and visible stressor bucket is improved. So that's just like one of our tricks that we'll get into when we get to the recovery, is you don't necessarily need to reduce your training if you just ramp up your recovery. ANDREW HUBERMAN: I'd like to take a brief break and acknowledge our sponsor Athletic Greens. Athletic Greens is a vitamin mineral probiotic and adaptogen drink designed to help you meet all of your foundational nutritional needs. I've been taking Athletic Greens daily since 2012.

00:36:29 So I'm delighted that they're a sponsor of this podcast. The reason I started taking Athletic Greens and the reason I still take Athletic Greens once or twice a day is that it helps me meet all of my foundational nutritional needs. That is, it covers my vitamins, my minerals. And the probiotics are especially important to me. Athletic Greens also contains adaptogens, which are critical for recovering from stress, from exercise, from work, or just general life. If you'd like to try Athletic Greens,

00:36:52 you can go to athleticgreens.com/huberman to claim a special offer. They'll give you five free travel packs. And they'll give you a year supply of vitamin D3 K2. Again, if you'd like to try Athletic Greens, go to athleticgreens.com/huberman to claim the special offer. I'm going to take the liberty of assuming that most people fall into one of either three bins in terms of their goals, again, most people. Certainly, there are going to be people that lie outside these bins. I think if you polled 100 people or 100,000 or 1 million people

00:37:26 as to what their major goals were in working out, they'd say, as you so nicely listed out before, aesthetic changes, functionality, and longevity. But that one in three really kind of sit higher than most people would like to perhaps even admit. They want to look good, which usually means they want to lose some fat, gain some muscle in specific places. I realize there are folks out

there who want to gain a lot of muscle and just muscle everywhere. But I think most people would like to have a little more shape here, a little more

00:37:58 muscle there to either balance out their aesthetic or to accentuate certain parts of their physique. And they would probably like to shave off some subcutaneous fat, although there are those exceptionally lean people out there. And they exist too. I think it would be gain muscle in specific places, lose fat, and do it in a way that also provides some boost to their health span and longevity. I would say that that might even be 50% of people out there. Again, I'm taking the liberty of guesstimating.

00:38:30 Another bin I would venture is interested in getting stronger and putting on more muscle. Certainly, there are a number of people that are interested in doing that. And that could even be more muscle all over or more muscle with some accentuation to certain areas where they happen to be weaker or less developed, as it were. And then the third bin would be people that really enjoy cardiovascular work. Oh, I should say the second bin probably care about their longevity also. But it's not really foremost, like, yeah, I feel great now,

00:39:03 and I'll live to be whatever. But I only want to do it if I get that much muscle. We know these kinds of folks. ANDY GALPIN: Yeah, I run a poll in my class every year when I ask, what, you guys all lift? And, of course, I make them put their hand up, like, you guys are in my class, you're going to put your hand up, let you lift weights. And then I ask, why do you train? And long term health is like on the list. And they all-- I'm like any of you that selected health are liars. You're 20 to 25. You are not exercising for health.

00:39:31 You are exercising because you want to look a certain way or get stronger. Once you get past that undergraduate age, though, the actual desire to live longer and better actually becomes pretty real. ANDREW HUBERMAN: Yeah, I think that there are people who want to feel better. They know that exercise and the results from exercise can make them feel better. But, yeah, that second bin tends to be more focused on the aesthetic changes, it seems, or being strong. And then the third category, I think, are people--

00:39:56 I know a lot of folks like this, who really enjoy what are normally considered endurance type activities. And here I just want to highlight again what you so beautifully illustrated in previous episodes, that you can gain a lot of endurance even using weights or machines. It just depends on how you use them. It's not about the exercise. It's about how you perform them and et cetera. And you, again, beautifully provided all those details as how to create endurance regardless of equipment standards, et cetera.

00:40:23 But that third category seem to be people who enjoy running, cycling, swimming, hiking, dancing, activities that they can do for long periods of time. That often will involve some sort of skill that is based on improving motor patterns, maybe not so much stride but certainly for people that really love tennis, people that love a sport, like golf. They want to be able to not just walk. They want to walk the 18 holes. They want to have a great golf swing, et cetera. I'm not a golf player. So forgive me if my nomenclature is off.

00:40:56 So there are three-- ANDY GALPIN: Golfer. ANDREW HUBERMAN: Yeah, golfers. ANDY GALPIN: You don't play golf. ANDREW HUBERMAN: Oh, got it. You don't play golf. ANDY GALPIN: Well, you play golf. You wouldn't call a golf player. ANDREW HUBERMAN: I played miniature golf a few times. And that's about it, although Stanford does have a beautiful golf course, I'm told. I should learn how to play golf. ANDY GALPIN: I'll come up and play it for you if you want. You come up. I'll play it. I'll tell you how it goes.

00:41:14 Get me on that course. ANDREW HUBERMAN: I can almost see it from my lap. So category one, I think, is a significant fraction of people. So as we lay out these different ways to assess goals and as we approach the structure of a program, as you'll tell us-- if we could perhaps touch back to those every once in a while. Again, I'm taking the liberty of assuming that we will net about 80% to 90% of people out there, again, those categories being people who want to lose some fat, maybe build some muscle in specific areas on their body,

00:41:47 and really want to be healthy. They want to feel great. And they want to have a long health span and lifespan. They want to live a long time feeling great. Second category, people want to build more muscle and strength. Sure, they don't want to damage their health. But that's not their main focus. Their main focus is on building muscle and strength. And then that third category of people who really want to do more endurance type work, feel great and strong doing it but not because they can carry heavy weights while they're doing it.

00:42:16 But rather, they can feel vital and they can push harder for longer and maybe even translate that to some of the more recreational type activities or sports, like tennis, and things that are more long duration, playing soccer or maybe even softball or things of that sort. ANDY GALPIN: Yeah, surfing, swimming. ANDREW HUBERMAN: So those three categories-- maybe we could call those bin A, B, and C for sake of today's discussion. I think if you're willing to embrace-- ANDY GALPIN: Yeah, I love it. ANDREW HUBERMAN: --I think that will be informative toward

00:42:41 our listeners in a way that-- simply not assuming what people's different goals are might not be able to accomplish. Said differently, hopefully, by doing that, people will derive a lot more from the description of the program that you're going to give us. ANDY GALPIN: Love it. ANDREW HUBERMAN: Now, I am certain that I want to let you return to your list of the five things

that people need to consider when establishing a exercise program. ANDY GALPIN: Yeah, great, let's do that. I also do want to acknowledge a point you've brought up.

00:43:08 Exercise doesn't mean just lifting weights. That's my background. That's what I spend my time on. So I sort of default to examples in that category. But it doesn't have to be that. You've articulated plenty of other ways where you can get amazing forms of exercise that have nothing to do with lifting weights. So for those folks in-- was it bin C or 3? I can't remember it. ANDREW HUBERMAN: Bin C. We go A is, again, muscle, lose fat, be healthy now and forever. Bin B is get stronger, gain muscle,

00:43:38 don't damage your health, but not really focus on health in the immediate term. And then bin C is want to play or do endurance type activities and, quote unquote, "feel strong doing it," so have more vigor to be able to do that longer and maybe with more attention to skill, et cetera, and, of course, also want to improve their health. ANDY GALPIN: Well, what you've effectively done is you've given us three different avatars with three different goals. So the next step for each person or group is going to be to identify their defenders.

00:44:10 But before we get that, we've got to close the loop on this SMART thing. So in each case, they have either chosen that goal based on their personal preference. Or perhaps they did our fitness testing protocol and realized they need to gain strength. So whether the reason they chose to be in buckets B or A or C was because of our protocol or just personal preference. It really doesn't matter. They still want to go through this process of laying out their goals and making sure, again, they are specific.

00:44:41 So let's go through bin C, which is a great one. So you want to have more energy. And you want to feel stronger when you're doing your kiteboarding. You want to feel stronger when you finish your round of tennis, round of golf, game of tennis. OK, great. That's a different strength. Absolutely see, I hear, I know what you're saying though. Amazing. So that goal needs to be specific to that. So it would be hard to make a goal like, I want to feel better at the end of my round. Boy, that depends on too many other factors.

00:45:12 A better goal would be something like this. I want to be able to run this 2-mile loop that I do around my neighborhood. And I want to do it and have a lower heart rate at the end. Or I want to be able to get my heart rate recovery back faster. Amazing, that will probably align with you feeling, quote unquote, "stronger" with it. So I did the same course. And either I could do it at the same speed and it's not nearly as hard or I can go faster, whichever one. It doesn't matter. But that would be an example of a specific goal.

00:45:48 The other buckets you laid out kind of already have specific goals, like I want to get stronger. Well, that's going to be the goal. The other one is going to be, I want to lose some fat. The goal is sort of implicit in that. It's the other people where you're just like, I don't really care about that. I just want to be able to surf the great waves and then not feel exhausted afterwards. All right, cool. Well, then you still should pick a metric that is not that activity maybe because it won't be within your control, depending

00:46:16 on the waves and the temperature and all that stuff, that you can use as a proxy to say, if I were to do something that represented me feeling probably better when I surf, what would that be? And it's not perfect. But it would be still as specific as you could get. You still want to make sure it's measurable. Again, this example might be something like you're going to go to the pool and time how long it takes you to swim 800 meters or something. It's attainable. And then you'll set a goal that's realistic and timely.

00:46:43 I'm going to improve by 5% in the next two months. OK, cool, that probably falls in the realm. And then you're making the assumption that if you did that, you'll probably feel better when you go out to do your primary activity, which is, say, surf. The reality of it is every time we work with an actual athlete, that's what we do. Athletes don't come to us to lift weights. They don't come to us to get stronger. They come to us because they want to play better. And they want to stay on the field more.

00:47:10 What we're trying to convince them of is if you do this thing in the gym, then that should translate into you being better at your sport, recovering faster, being less injured. But it's still just a proxy. And so that's all you're doing with these other non-specific goals, especially when they're performance based goals. And we didn't package it that way. But that's really what you talked about for bin C there. It is a performance based goal. I want to be able to perform when I'm in the field. In my brain, that's a sport.

00:47:37 In your brain, it's when you're at yoga class. It's the same thing. We've said this earlier in our series that if you have a body, you're an athlete. I want to prepare your body so that it can do exactly what you want it to do. You then get to have the choice of what you ask it to do. You call it a sport. You call it your Saturday hike with your family. I don't really care. It's the same thing. You get control of your body performing the way you want it to perform. And that's what this whole thing is about.

00:48:03 Great. So now that we've covered, I think, as much as we need to regarding assessing and choosing a goal, I want to get back to this idea of identifying your defender. So you really need to think carefully about what is stopping you from hitting those goals. And so you're forecasting a little bit. You're also going back into your own personal history. Do you have history of

knee pain? Do you have a history of working too much? Do you have a history of a lot of travel? Do you have a history of getting sick a lot?

00:48:34 What are these things that are happening that are going to stop you from hitting your goal? A couple of examples I've already laid out so we don't need to go too much longer here. But in the case of somebody who is in maybe bin A, which is I want to lose some fat, maybe gain a little bit of muscle, OK, what's stopping you from the strength and conditioning side? Is it the fact that you can't train consistent enough? Is it the fact that when you go to train, you don't know what to do? Is it the fact that when you go to train,

00:49:01 you train your ass off and you're not getting results. OK, great. All three of these different scenarios are going to result in different programs because they have different reasons you're failing. And that is really critical. Instead of just going I want a fat loss program and picking one up off the internet, it may not actually be addressing the point of failure for you. So the sooner you can choose your programs based on why you're failing, the sooner you'll start getting results. You have to run a little bit of a critical analysis there.

00:49:34 And it can be something scientific. And it could be a measurement. And it also could just be thinking about you've tried this in the past and why didn't it work. It wasn't that interesting. OK, tell me more about why it wasn't interesting. I'm not really into machines. And that's all I had. OK, great. Or I loved it. I loved the gym I was at. And I was getting results. But it was so far away. OK, interesting. Why did you stop before? Why didn't it work? Or if it did work in the past, amazing. Let's go back to something similar.

00:50:09 But has your life changed at all? Is there anything different about now than when it worked three years ago? Yes, no. If not, maybe we run it right back. If it is, OK, we're going to predict those things. And you want to work-- effectively, what I'm saying is throughout this entire 10-step process is going to be you want to make sure that there are the non-negotiables that are in your life that you know are going to be ahead of your fitness program. And you want to work with those things, not against them

00:50:36 because life will win. When it comes to your children, when it comes to your job, life is going to win. You're going to have to give up something. It's going to take some hard work. But we want to fight the right battles for most people. Even for our professional athletes, we get this all the time. It's just like they have nothing else to do but train. Like, whoa, whoa, hold on now, they're getting traded. They have agents to deal with. They may not have a contract. They have families, blah, blah, blah.

00:51:00 Life will get in the way, I promise. And so you want to fight the battles that you can win, not ones that you're going to lose. And so that's really what this game is about. So if the battle is, hey, my job is super hectic, OK, great. We're going to come up with a different strategy that's more flexible maybe. I'm still going to hold you to the fire. I'm not going to be easier on you. But we're just not going to try to set up a situation where you have to do this workout Monday, Wednesday, Friday, and Saturday

00:51:27 because you know your job is on the road. And you're to provide all income for your family, whatever the thing is. That's what we really want to identify. So when I say identify your defenders, you need to run a little bit of a critical analysis on this. And a little bit of a tool I'll use for this is a modification of another system I stole from Kenny Cain, which is what we call the quadrant system. So you can imagine everything in your life goes into one of four buckets. Now, bucket 1 I'm just going to call business.

00:52:01 And this is anything to do with your job, income, sort of all those things. Bucket 2 is relationships. So, again, this could be family or love life, anything that we would call relationships-- social connection, purpose, anything, right? Bucket 3 is your fitness. And bucket 4 is your recovery. So one of the first steps we take is we walk through this. And we say, all right, you have 10 points total. And you get to distribute these 10 points across the four areas. So not 10 each, you get 10 total.

00:52:40 And so we walk through. And we say, right now, where are you giving your points? And we could do this right now for you if you'd like. Or I could make up a scenario. You want to do it? ANDREW HUBERMAN: Sure. ANDY GALPIN: Great. So, Andrew, right now in the last month, if you had 10 points total in those four categories, where would you be distributing the most points? Which category? And how many points would that be? ANDREW HUBERMAN: Business, my work. ANDY GALPIN: Business, work job, sort of all those things.

00:53:08 And how many out of 10? ANDREW HUBERMAN: Which doesn't, I should say, ever quite feel like work. Running a laboratory and doing the podcast doesn't ever really feel like work in the traditional sense. But it's career. It's work. It involves relationships. But it certainly doesn't enhance my fitness except of my vocal chords and recovery. So with those notes there, I would say 4 to 5. ANDY GALPIN: You pick. ANDREW HUBERMAN: 5. ANDY GALPIN: 5, fair. That's the most common number, business 5. ANDREW HUBERMAN: Great.

00:53:46 Once again, I'm typical, which makes me happy. ANDY GALPIN: You nailed it. ANDREW HUBERMAN: One of the few ways in which I've been accused of being normal. I pick 5 for business. ANDY GALPIN: No kidding. What's the next highest? And what's that score? ANDREW HUBERMAN: I do invest in relationships. I would say does it have to be around-- can it be-- ANDY

GALPIN: It has to be a whole integer. ANDREW HUBERMAN: A whole integer. 2. ANDY GALPIN: 2, all right, we're 7 out of 10 here. So would you say it is fair that you

00:54:19 spend roughly 2 and 1/2 percent of your-- it's not necessarily time. It's energy, time, focus, and sort of all of these things-- 2 and 1/2 times as much on your business as you do in your relationships? ANDREW HUBERMAN: It varies, depending on what's going on. It feels a little skewed in the direction of business. So I might want to adjust to a 4 to 3 ratio there. ANDY GALPIN: Maybe not. ANDREW HUBERMAN: But I think I'm going to hold to 5, 2, business, relationships. And then, just for sake of example

00:54:50 and because this doesn't seem like an exceedingly precise measure, it can have some slop. ANDY GALPIN: Of course. Where would you put fitness and recovery? ANDREW HUBERMAN: I definitely put energy into fitness. So I'm going to give that also a 2. ANDY GALPIN: Yep, which leaves? ANDREW HUBERMAN: 1 for recovery. ANDY GALPIN: Great. That what you just laid out is, again, the most quintessential split you could have. In fact, you run this game on everyone, they're going to come up with basically the same answer

00:55:23 unless they don't work out or whatever. So a couple of rules here. Recovery must be at minimum half of your fitness allocation. In your case, 2 to 1. You're fine. ANDREW HUBERMAN: I think I'm going to say it has to be half. It has to be 5 out of 10 points. ANDY GALPIN: No. ANDREW HUBERMAN: In which case, it doesn't leave much for anything else. ANDY GALPIN: I would like it to be minimum 20% of the total, which means 2 out of 10. Now, when I say recovery, I don't simply mean muscle. I mean you need personal time.

00:55:50 You need meditation. You need-- ANDREW HUBERMAN: Sleep. ANDY GALPIN: -- sleep. You need to go to a concert and get out and see people. And so like whatever the things that give you energy back. Some folks, that's personal time. Some folks, that's social time, whatever that means to you, right? ANDREW HUBERMAN: Yeah, I actually get a lot of energy from my work. And so that's why some of these numbers are a little bit-- you can kind of cloak the underlying dynamics. ANDY GALPIN: So here's what we do from this game.

00:56:16 We look at that and we say, if that's our split, Andrew, 5, 3, 2, 1-- ANDREW HUBERMAN: 5, 2, 2, 1. ANDY GALPIN: 5, 2, 2, 1. ANDREW HUBERMAN: I'd love to be able to put 3 in relationships just because. But then they need 11 out of-- ANDY GALPIN: Right. So here's the fun game we play. You're currently at this. And you don't get to add to 11. You have to stay at 10. Your 10 is different than my 10 maybe, right? But 10 is 10, or just-- whatever the maximum you can actually do. It's you. So if we went back to our training goal, whatever

00:56:45 that goal was for you, and we went back to our defenders, we would look at this score now and say, is 3 out of 10-- fitness is 3, right? ANDREW HUBERMAN: Fitness is 2. So it's 5, 2, 2, 1. ANDY GALPIN: Is 2 out of 10 sufficient to hit that training goal in that time frame you described? And let's say you said, I want to hit a new PR in my mile six months from now. ANDREW HUBERMAN: Yeah, for simplicity's sake and also because it's largely true, I'm going to put myself in what I refer to as bin A earlier.

00:57:18 My body fat percentage is OK. It's in the range that I would like. But I would like to bring it down a little bit, probably gain a little bit muscle here and there, keep or gain some endurance. And, certainly, certainly, my immediate and long term health are extremely important to me. ANDY GALPIN: Great. So then the question, and the answer maybe yes, that this is the optimal split for you. If it is not, then we have to make a choice. We either alter the goal or the timeline to make it realistic

00:57:47 or we alter our quadrant. And then if we're going to alter our quadrant, the next step is critically important. We need a list of very specific life actions that we're going to take that allows that split to happen. So if you said, for example, I want to put three into relationships, great. What specific life actions are you going to take to pull one from fitness-- you can't pull any from recovery or one from business. And you don't have to actually answer. This is-- ANDREW HUBERMAN: Too personal.

00:58:19 ANDY GALPIN: I know you don't like making these things about you because-- ANDREW HUBERMAN: Right, that's the other reason to do it. And it is a diabolical trick to insist that these be whole integers because I would have done like a 4.5 for business and a 2.5 for relationships. But, obviously, you write the rules on this, not me. ANDY GALPIN: So you would just walk that list. And the list could be something like I promise to not work after 7:00 PM Thursday through Sunday or whatever the thing is.

00:58:48 I promise I'm going to make sure that I don't start work before 8:00 AM or blah, blah, blah, whatever. No more trips. Just make those things specific and measurable, not just like I'm going to work less. That's never going to go-- what is the very specific life action you're going to take? There's going to be alarm that goes off Tuesday night at 4:00, 5:00 PM. And no matter what we-- at Barbell Shrugged, we used to have a little shirt that was like D3AT, which is like drop everything and train, which means at 3:00 PM in the afternoon,

00:59:18 no matter what's happening, we dropped everything and trained because that was like when you start a business and you're going, things just run away from you. And it is just sort of like, man, it's not my company. But those guys are like, we are a strength and conditioning company. And we're not training. So we had to just make this hard rule. And it was just like a little

thing that came up. And it was easy to say drop everything and train 3:00. There you go. ANDREW HUBERMAN: I like this drop D, E everything, A

00:59:43 and, blank, like it could be drop everything and-- ANDY GALPIN: Correct. ANDREW HUBERMAN: --pick your favorite. ANDY GALPIN: Totally. Drop everything and read. ANDREW HUBERMAN: Pick the relevant-- read, yeah, absolutely. I really miss reading for pleasure. I would put that under recovery and-- ANDY GALPIN: Drop everything and breathe. ANDREW HUBERMAN: Oh, and breathe you are saying. Oh, and breathe. I was saying read. ANDY GALPIN: I said that too. ANDREW HUBERMAN: Yeah, because for me, reading is actually

01:00:03 is both recovery and relationship. Because oftentimes in my relationships, I've insisted-- not insisted. I certainly didn't insist. We've had a format of reading the same book in parallel. ANDY GALPIN: Oh, great. ANDREW HUBERMAN: Yeah, not necessarily side by side but the same book in parallel and then discussing it. It's a wonderful practice or listening to the same audio book. ANDY GALPIN: Yeah, it works well. You can do drop everything and play. You're just going to go do something. You're going to play video games.

01:00:28 You're going to go play with your kid. You're going to-- do you want to play with your dog? It doesn't even have to actually be play. But play to you could signify personal time. It doesn't really matter. So, yeah, that's it. ANDREW HUBERMAN: I really like this drop everything and blank category that you probably shouldn't have more than what? Two or three of those overall? ANDY GALPIN: Pretty much one to two maybe is where you want to go after that. ANDREW HUBERMAN: So the idea is then to redistribute the numbers on this list

01:00:54 but through a very concrete action. And I like this drop everything and blank because it speaks to the non-negotiable aspect of it. ANDY GALPIN: Has to be. Life will get pushed. ANDREW HUBERMAN: It's not a fine time to-- it's not in next year I'm going to-- ANDY GALPIN: Correct. ANDREW HUBERMAN: I love it. ANDY GALPIN: Yeah, yeah. When you put those things-- those things, you might as well just don't even put it on your list right. It's not going to happen. ANDREW HUBERMAN: Yeah, you're talking

01:01:20 to somebody who loves rules. Because when they are non-negotiable rules, they provide this incredible organizing force for the brain. It's really a neuroscience thing in my mind. ANDY GALPIN: Totally. ANDREW HUBERMAN: And, actually, we did an episode on happiness where you find that once people make a decision, if they eliminate the possibility of other decisions, like, literally, the hatch is closed, that is it-- ANDY GALPIN: Burn the boats. ANDREW HUBERMAN: --the rates of subjective happiness,

01:01:44 immediate and long term happiness, over time go way, way up. And so I'm convinced that the nervous system doesn't like to keep the valves on these dopamine circuits open. I actually think it diminishes from the reward component. And there are actually some data on this. Anyway, I don't want to take us off track. ANDY GALPIN: The last part of this, what we do then is we take that quadrant. And we take that list. And then you're going to print it physically. And you're going to put it in two places.

01:02:07 This could actually be on your phone. You don't have to print it. You can screenshot and be the background of your phone. So every time you click on your phone, you immediately see that quadrant. It's a very clear reminder of like, what are my priorities today? Just a simple little picture. I also like to put it in your place of failure. So for a lot of people, that is like on their laptop or right above their workstation. It's the thing that's going to lose and beat your fitness is your job-- typically.

01:02:33 Or it's on your TV, it's on your Netflix control-- no, sorry, Netflix, no offense. But you know what I mean? It's whatever the thing is that you fail for. I play too many video games. Great. I work too much. OK, great. And you put it there. And you put it also-- the last component is-- it has to also be in the hands of somebody who can hold you accountable. Wife, training partner, business partner, whatever. So it's like, hey, Andrew, you promised you were going to do x yourself. Why are you still here?

01:03:01 You committed to this. You've got to get out of here. Someone who will be like, no, no. It's drop everything and read. It's 8:00. You're supposed to be reading. You got to go. You're going to check back in on that. Check back again every week. Check back in-- it doesn't matter, every month. And then, you can adjust. That's fine. You can always change the system. But that has to now change. You've got to print a new one. And now it's a whole new promise you've made to yourself. So you've got to be able to hold yourself

01:03:25 accountable to those things. It's got to be flexible enough to where it's realistic. It can't be, I'm not going to work after 6:00 every day. Maybe it's just three days a week. Maybe it's, on Saturdays I promise to work for the first two hours so I don't work Saturday night. Or whatever, or the inverse, I'm not going to work Saturday-- you get it. You could come up with a million examples here. So that's the system we use to make sure that we have now properly identified where we're going. We found a roadmap to that.

01:03:53 And now we know exactly how we're going to stay on track. I have to take this opportunity to add one more thing to our drop everything list. And you gave the example of DEAR, which is maybe drop everything and read, or drop everything and relax. Or another example, I have to add a DEAL, which is drop everything and-- this is for you, Lex-- love. ANDREW HUBERMAN:

Actually, one of the advantages of having a dog or having children is that the drop everything and love is often enforced by the faces of those that you love.

01:04:29 They just show up in whatever space you happen to be in. ANDY GALPIN: Especially if you work from home. ANDREW HUBERMAN: I'd like to take a brief break to acknowledge our sponsor, Inside Tracker. Inside Tracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals. I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate and long-term health and well-being

01:04:53 can only be analyzed from a quality blood test. One issue with a lot of blood tests and DNA tests out there, however, is that you get information back about various levels of lipids, and hormones, and metabolic factors, et cetera. But you don't know what to do with that information. InsideTracker makes knowing what to do with all that information exceedingly easy. They have a personalized platform that lets you see what your specific numbers are, of course, but then also, what sorts of behavioral do's and don'ts, what sorts

01:05:18 of nutritional changes, what sorts of supplementation would allow you to bring those levels into the ranges that are optimal for you. If you'd like to try InsideTracker, you can visit InsideTracker.com/Huberman to get 20% off any of InsideTracker's plans. Again, that's InsideTracker.com/Huberman to get 20% off. ANDY GALPIN: Let's move on to the next one, shall we? Number three here is going to be what I call calendar or time frame. So it's going back a little bit and saying, you've decided on this goal and you've

01:05:47 identified the defenders. Now we need to come up with a realistic time frame for how long it's going to take to accomplish that goal. And when you do that, you need to look at your life schedule. And what I mean by that is do you have important deadlines coming up? Do you have a holiday? Do you have a trip? Do you have travel? Do your children have something coming up? You need to take all that information. And I literally lay out a calendar. And I write all those dates in a physical calendar first.

01:06:18 And the reason I'm suggesting this is you want to work your training backwards around that. As we've been discussing, life will win. If you try to plan a training program that is five days a week 90 minutes a day, and all of a sudden, you look two weeks from now and you realize you've got a grant deadline. And then you've got to take two days to go to Austin. It's just foolish. You're going to fail. And then you're going to quit. And you're going to be like, man, again, my training program failed.

01:06:44 So you need to figure out what are the non-negotiables are in that business quadrant, and just not be foolish. So let's imagine you're going to plot out, say, a 12-week training phase. And you want to-- you've decided on this goal. And then you look and you realize in the middle of this 12-week span, week five is really hectic and chaotic. Or you realize that this is a quarter in which something important is due. Maybe we want to either adjust the goal. Or what we really do in this step is going on

01:07:18 to actually step number four, which is choose the number of days per week you can exercise and the length in terms of amount of time you can truly afford to train. I would rather you underestimate that than overestimate it. So you, again, you look at the calendar. You put all these non-negotiables, the deadlines you cannot move in the calendar. And then you say, look, based on this, realistically, I can conservatively train three days a week for 60 minutes total. And that includes the time I walk

01:07:51 into the gym, my warm-up, my down-regulation breathing at the end, and then me getting back either in the shower and back. Because really, now it's maybe 90 minutes by the time you traveled, you transitioned, you picked back up on work, you showered, you ate, et cetera. That time just runs away from you. And all of sudden it was a two and 1/2 hour thing even though it was a 45-minute workout. So you really need to figure that thing out. If you're a few weeks in and you realize, ooh, I actually have a little more time than I thought,

01:08:15 you can always train more. You can do another thing. You can add up. But what you don't want to do is set up a program that is requiring you to do certain exercises on one days or certain styles of training on another, and then you constantly miss one of those days. I thought I could do four days a week, but one day a week something's getting pulled out. That's just going to keep you off schedule. It's going to make you feel like a failure. And you're going to run into problems with your training.

01:08:40 So schedule three if you're sure you can get three. And if there's an extra day, we can always do other fun stuff. So that's really step three and four. Figure out your life events over the course of this time. How many days a week can you train? And then how long in terms of minutes per workout. Notice, we haven't selected a single exercise yet. We haven't worried about how heavy, rest intervals, all those modifiable variables. You don't need to pick those later. First, where are we going. Second, how are we going to get there, which is the quadrant

01:09:12 and identifying of defenders. And then the third is, what are the restrictions I need to place on myself in terms of program design based on how often and how long I can work out. That is going to allow you to go back to some of the previous episodes and go, man, you gave us all kinds of ideas. How do I know which one to choose? This is your answer. You're going to choose based upon

the limitations of time and frequency. So if you've already said, we're in-- let's imagine we're in bucket A, or bucket C. It doesn't matter.

01:09:44 And you go, look, the most I can afford with where I'm at with what's going on in my life is three days a week. Well, we automatically know we're going to have to start training-- choosing a training style that's limited to three days a week. Don't even worry about the four or five day stuff. Those are off the table. And now we're on-- so we've placed restrictions. It goes back to that concept of I think it's one of your podcast's guests, Jocko. It's just like, hey, structure gives us actually some freedom.

01:10:11 So by creating some restrictions here, we're a little more free to go, I only actually have to choose between A and B. Rather than sitting down and going, man, there's all-- I'm 20 hours into this exercise podcast thing. And there's so many options. Which one to pick? Well, you create a little bit of restriction. And now it's easier to go, oh, my only option is A or B. And there we go.
ANDREW HUBERMAN: So that's number four. ANDY GALPIN: That's three and four. At that point, once we're good there,

01:10:35 now what you want to do us go to step number five, which is actually select your exercises or your movements. And this can be as simple as selecting a kettlebell swing, or running, or swimming. It could be your entire exercise mode. What you want to do with exercise selection here is make sure that you're balancing those exercises across the whole week. Not within necessarily every workout. So if you have four days a week, five days a week, you want to look at the exercise selection and say, OK, I need to have somewhat

01:11:09 of a reasonable balance between movement patterns, or muscle groups, or front and back, side to side, however you're thinking of it, just across that week. So again, say we're on a three-day program. And we're in either of the buckets-- any of the buckets, really. And we say, OK, great. Maybe it's not ideal if all I select is cycling every day. That's not a lot of balance. I don't notice anything. There's no upper body work there. There's no torso work. There's no other positions. So maybe I'm going to really focus on cycling.

01:11:43 So I will do only cycling two days a week. But that third day I need to pick something for the other movement areas. And that's going to make sure you stay in a reasonable balance. If you have an exercise that you like, great. If you have exercise you have access to. Again, maybe the gym is a giant pain in the ass. And so you can say, look. That's too far away. The closest one is 45 minutes there and back. So maybe I'm going to restrict myself to only kettlebell, and bands, and running, because I

01:12:08 can do those in my house. Awesome. We've actually created some freedom because we gave ourselves some restriction. And now we just have to figure out how am I going to give some movement patterns somewhat balanced across my three days. So really, when it comes to exercise choice, it is selecting the patterns that you know how to execute. Giving yourself, again, somewhat of a balance between the muscles, and the joints, and the movement patterns. Making sure that you are specifically targeting any muscle group or movement that you want.

01:12:42 So making sure you want to improve muscle size in your glutes, you better make sure some of the exercises you're doing at least one day a week you're feeling in your actual glutes. So you can check that box. It doesn't have to be every exercise. It probably shouldn't. It doesn't even have to be every single day. But make sure it's checked off somewhere on that list. And the last one is, is there a strategy in which you can progress it? So if you're like, I'm just going to do bodyweight exercises.

01:13:10 OK, great. Well, how are you going to progress those? In the case of bodyweight, it's really hard to add load. Maybe you can put a weight vest on or something. But then, maybe you don't have that, or that's an extra thing, or that can only go so far. So what's my progression strategy going to be? Well, in this case, maybe you just increase the complexity by going from two legs, like say a bodyweight squat, to a single leg squat, or you just increase repetitions, or you increase time you're going to hold it.

01:13:35 My point is, your progression strategy will be based upon the restrictions that you place based on availability and things like that. The last thing I always recommend here in terms of exercise progression, to make sure that you can continue to do these things while lowering your risk of injury, both in the short-term and long-term, is to progress your exercise complexity in this fashion. So make sure, number one, you can do the exercise properly with assistance. So let's imagine a scenario where

01:14:07 we're going to try to squat. So give yourself-- put your hands on a bench or something like that. Now, can you execute that squat perfectly with assistance? So you're holding onto something. Great. If you can't, then don't progress past that. Don't go now to a barbell back squat if you can't do it correctly when you have assistance. But let's assume most people can do that. OK, great. Now you can move on to the next step, which is can you do it well without assistance. So this would be bodyweight only.

01:14:37 Check, cool. We're good there. Now you can go ahead and move on. Can you do it well with an added e-centric load? So in this particular case, if we're learning a squat, we can do it well when I hold on to something, that's great. Now I can do it well with just my bodyweight. Now if I put a little bit of weight on, whether it's a kettlebell in the front like a goblet squat, or dumbbells to

the side, or whatever you want to do, can I lower it and go all the way down and stay in perfect position? If you can do that, great.

01:15:06 You're allowed to go to the next step, which is can you hold it isometrically. So can you go all the way down and then hold that bottom position? What you don't want to do is start adding load, or speed, or fatigue if you're going down to the bottom position of the movement and you are out of control. We really want to avoid this. So I want you to show me you can go down and you can lower the weight under control. You can hold it in that position under control. If we're clear there, now we can add the concentric portion.

01:15:42 You can now go ahead, you can lower it, you can hold that position of most danger, and now you can move up at whatever speed we want. We are all good there. Once you can show me those things, you can add the last two steps which are now speed-- if you choose to-- and the last one, which is fatigue. I would really discourage people from doing exercises to fatigue, especially with a moderate or high load, unless you can promise me you can do these first six steps. If you can, you can basically go hog wild with your training,

01:16:13 and your chances of injury are very low. Again, both acute injury, as well as long-term injury, which is just sort of like my joints ache, and all of a sudden my shoulder hurts, and things like that. That's really what I'm looking for. And once you're clear there, you can train pretty hard. ANDREW HUBERMAN: I really like this. Because, recently, I was showing somebody how to use a-- in this case, it was a hack squat machine. I notice they were very timid of getting into a deep squat position. And they cited a previous knee injury,

01:16:45 which has long since healed. ANDY GALPIN: Right. ANDREW HUBERMAN: But even with proper foot placement and everything, you just tell, they were getting ginger about it as they approached that bottom position. But over time, with pauses at the bottom, they've become very comfortable. And now actually are going well below 90 degrees angle between femur and lower leg. ANDY GALPIN: Excellent. ANDREW HUBERMAN: So it was clear that it wasn't something range of motion limited or it was just-- it was a mental thing, but a logical one for them.

01:17:17 Now, after what you just said, I think a better strategy that I could have used would have been to have them get into that position, just no weight at all, maybe nothing on the sled, and then slowly working up from there as opposed to doing what we did in our case, which was to just convince them that they were much stronger than they thought they were. We eventually got there. But I'm realizing that there was far too much mental anguish involved in that process. ANDY GALPIN: Yeah. This whole progression, by the way,

01:17:45 this can all happen in one session. If you can check the boxes. In that example, you may have been fine to jump there. It may have just been a, hey, you're fine here. Get through it. Oh, OK. This whole progression might take two years. I mean, this really depends on your background, if you actually have injury history, your comfort, your confidence, all these things. So you don't need to worry about rushing through that progression. You don't even need to get all the way to the end if you don't want, especially with speed and things

01:18:11 like that. But again, it can happen. It doesn't have to be like, well, it's a month of this, a month-- well, no. If they feel great and you can go through one to seven in five minutes, then you're good to go. ANDREW HUBERMAN: Number six. ANDY GALPIN: Number six now is just order. So you know how many days per week you're going to work out. You know how long they're going to take. You've selected all the exercises you need to get done. You've balanced that across the week. Now you just need to put them in order.

01:18:36 And the easy answer here is generally do what's most important first in the workout. There is some minor interference effect of some other things there. But the reality of it is, if you do the priority first, you're probably going to be OK. So whether this priority is a muscle group. So in the example, you want to make sure your glutes get trained. Maybe do it first. If you're trying to maximize your back squat, you may not want to do a bunch of glute exercises to fatigue first. But that's not the priority we picked.

01:19:10 We picked a different one, which is buckets A, B, and C. OK, great. By doing it first, you told me the priority was to make sure I do something for my glutes. And then I would also like to get my back squat a little bit stronger or whatever. Fine. The same thing could be done for your endurance training. You could do your endurance training before your lifting if you understand that that means you might be compromising your lifting quality of the workout a little bit. But you might be fine with that if you

01:19:38 say the endurance work is more important right now. Amazing. You don't know the answer to that though if you hadn't gone through steps one through four. And that's why those things are critical. So it makes what we call chaos management, which is things happen in the moment. I don't know what to do. What should I choose? That decision becomes really clear because you can always go back to the beginning of my priority was this. Then therefore, that's my choice today. So it provides a very simple set of instructions

01:20:06 for when the workout gets cut short, when your workout has to be in a hotel, and any number of things that pop up in real life, whether, again, you're an athlete or non-athlete. Either way, life will get in the way at some point. So you need to have rules and a system that says, when this happens, I go right back to this. And that's my choice. Done. I'm moving on. No decision to make

here. It's already been determined a week ago, five weeks ago. We're often rolling. So the order, again, is pretty simple.

01:20:34 Just put the one that is most important first. Now, I know you like to do legs on Monday. That's great. I actually love that too. I do the same thing generally, because to me, that's almost always the most important thing. If I miss a bicep workout, I'm probably fine. But I really don't like missing the big movement pattern. So I make sure that those happen on a day that tend to be more stable for me. Mondays are generally pretty stable. Things get chaotic as the week moves along for me. Others might be the opposite.

01:21:05 Others might want to go, hey, I'm actually going to keep Monday as my flexible day or off day because I like to get a lot of my work done, get that cleared so I can have-- oh, sure. Work it around you. Some people love to train on Saturdays because it's their most free, some people hate it. Sure. You tell me, what is the biggest priority, and what are you the most fresh? Monday, Tuesday, it doesn't matter. It depends on your work schedule. Maybe you work the weekends. I don't know. You decide what day of the week are

01:21:32 you generally the most consistent, the most consistent schedule, and the most consistent energy. And do the thing that is most important on that day. It doesn't matter Monday, Tuesday, day one, day three. We were sort of talking about this earlier. But you actually don't even have to do a week schedule. Our brains tend to like to go year, month, week. But a lot of folks will even just run this thing in terms of a seven or nine-day schedule. In fact, we ran a nine-day training schedule for one of my Major League Baseball players.

01:22:01 And he's eight or so years into his career. And he's hitting all-time PRs in velocity. And he's very, very good. And it was a nine-day training cycle. And we ran that for the entire season. So it doesn't have to be a seven-day split. But it tends to work for a lot of people because most people have a fairly consistent schedule across the seven days. So pick the thing that is most important and do it first, and do it on the day of the week that is most consistent for you in terms of schedule and energy.

01:22:29 ANDREW HUBERMAN: I really like what you're describing. I should just say that one of the reasons I put legs on Monday is because I tend to get enough sleep on the weekends. I generally get enough sleep during the middle of the week. But oftentimes, things will come up. I can be pretty sure, however, that I've, quote unquote, caught up on my sleep on the weekends. This notion of catching up on sleep is a little dicey scientifically. ANDY GALPIN: Yeah. ANDREW HUBERMAN: But I tend to be pretty rested by Monday

01:22:50 morning. ANDY GALPIN: Right. ANDREW HUBERMAN: And actually, my week begins on Sunday. And Sundays are when I get my long form cardio. ANDY GALPIN: There you go. ANDREW HUBERMAN: So those two are really non-negotiable. And the reason that long form cardio is on Sunday is that it can take many different forms. It can take a hike with a weighted vest. It can take the form of a jog. It can be done with other people. It can be family time. It can be time with friends and so on. And that's pretty hard to do during the middle of the week

01:23:16 or pretty hard to ensure, at least for me. I also find that by bookending the week with some non-negotiable days of training on Sunday, Monday, then if the week gets busy Tuesday, Wednesday or even sometimes Thursday with travel and things like that, one can catch up toward the weekend. It's not ideal. ANDY GALPIN: Yeah. ANDREW HUBERMAN: I mean, ideally, it's spaced out. But really, this isn't about what I do. This is really just to underscore the principle you described, which is, I have a very clear sense now over three decades

01:23:44 or so of training and three decades or so of being involved in academics, and science, and work, of when I tend to be most rested, when I tend to have some flexibility in my schedule. And also, when I'm trying to combine fitness with some of my social engagements, which is actually quite fun. One thing I note is that the four boxes that you mentioned before, work, relationships, fitness, and recovery. Some of them do have some crossover. ANDY GALPIN: They all do. ANDREW HUBERMAN: A hike with family or friends

01:24:11 is both relationship and fitness, and so on. But I love the principle. Because anything that can add consistency, as you pointed it out, is going to greatly increase the probability of reaching one's goals. That's sort of an obvious one. But in an earlier episode you also said something that I wrote down and is really still ringing in my mind, especially now, which is that consistency always beats intensity. ANDY GALPIN: Correct. Yeah, absolutely. We used to do a thing-- when I was training NFL players for the combine many years

01:24:44 ago-- where Saturdays were supposed to be the day they came in and we did the most regeneration. So this is when they get body work done. And we do hot cold contrast and sort of all these things. And our attendance was like 1%. Nobody showed up. ANDREW HUBERMAN: For a massage? ANDY GALPIN: Nobody showed up. ANDREW HUBERMAN: Wow. I'm surprised. ANDY GALPIN: Seems right. But remember-- ANDREW HUBERMAN: I love a good massage. ANDY GALPIN: Of course. But remember, you're 18 years old. You're likely to be getting millions

01:25:11 of dollars handed to you in the next few weeks or months. And-- ANDREW HUBERMAN: He's not referring to me, by the way. ANDY GALPIN: No, no. ANDREW HUBERMAN: I'm actually quite a bit older than 18. [LAUGHS] And I'm not getting handed millions of dollars each week. ANDY GALPIN: Right. So I would think that. But those folks, they recover super fast. They've

never really had that. And also, Friday night, kind of enticing. And so, nothing was there. And the strategy then was, what if we instead of having a important hard training day on Saturday

01:25:44 we transition and it is only things they want to do. So we basically identified, what are the things in training you love the most, and let's do those Saturdays. And it turns out for those folks, no surprise here, it was what we call the gun show. So they would come into the gym. And we would literally do nothing but biceps and triceps. They'd just get a pump. And then the deal was though, you come in-- and literally, it would come in is, we would pick three guys. Say you, you, and you. You pick your favorite bicep exercise.

01:26:10 You pick your favorite one. You pick your favorite one. You three over there, you pick your favorite tricep, tricep, tricep. And we just run a big circuit. Like this is, how many reps? I don't know. I don't care. How many sets? I don't even care. Just pump away. I don't even care. We chose small muscle groups. Not really going to interfere with much. We're training them for the NFL combine, which is-- it's not a-- it's a legs performance, basically. So it's like, if they smash their biceps and triceps

01:26:33 on a Saturday, it's not going to influence what we did on Monday. So recovery wasn't an issue. Once we finish the gun show though, now you have to go do your regen stuff. So if you need chiro work, you need physical therapy, whatever you're going to do. So we would get them in the building with the low-hanging fruit. And then we would actually get them to do their work. You can do the same thing. And I honestly do the same thing. I tend to do either-- if I'm going to do an upper or lower split,

01:27:00 I'm going to do that stuff either Friday night or Saturday. Because it's very difficult for me to do a hard long workout Friday night or even Friday morning for that matter. The same thing Saturday. I wake up. And now it's like, it's family mode. It's kid things. I want to do stuff. I want-- man. But I can usually convince myself to be like, all right, just go in there and go 20 minutes and get your upper body stuff done. All right. I can walk myself into that mentally. It's harder to walk yourself into your five

01:27:27 sets of five Deadlift. It's sort of just like, whoa, I ain't got that in me right now. My high intensity intervals, the max stuff, I don't have that right now. So I'll either go for my long steady state stuff, which is like, I'm going on the bike. I'm riding down to the beach, or coming back, nasal only, I can get myself to go for a bike ride, whatever. So I picked the thing that I'm likely to do on the days where I'm probably going to be my weakest, quote unquote. Not physically, but motivation-wise.

01:27:56 For a long time I try to-- it just got stuck in a way where my harder stuff was Friday nights. And I'm just like, why am I doing this? I was having like a 50% success rate. Just like we were having a no percent success rate with the NFL guys on Saturday. So you have to be a little bit tough. You have to grind sometimes. You have to get some motivation and go after it. But you also have to be like, well, this is just stupid planning. Why put yourself in a position where you're just failing over, and over,

01:28:24 and over, when I could move it and go, look, those sessions are going to be things that are easier. They don't require as much gusto to get up and get them done. I get those things done 90% of the time. Because the worst case I can be like, all right, we're going to go do a family thing. Give me 20 minutes. I'm just going to run up there and smash upper body. And you don't need-- I need a 20 minute warm-up. [LAUGHS] It's like, I can just jump into those things if I had to. If I feel great, then I can still go do something else,

01:28:54 or I could do more, I could do a longer session. But you're sort of immune to any situation. So I would book-end those, I guess, is what I'm saying. What's the day you're going to have the best day, and what's the day you generally have the worst? And put the programs around those situations. ANDREW HUBERMAN: Yeah. I love the idea of identifying the friction points, the high friction and low friction days. ANDY GALPIN: Yeah. ANDREW HUBERMAN: Friction meaning anything that impedes you from training consistently or well.

01:29:18 And there are so many factors that ratchet into that-- sleep, other social engagements, work. Friday night, I also find it tough to do any kind of training. I do cardiovascular training. I do interval type training on Fridays typically. But there's a lot of cumulative fatigue and stress that happens across the week. ANDY GALPIN: Right on. ANDREW HUBERMAN: And usually, for a long time, gosh, more than a decade now, I've been telling myself that Saturday is the day that I try to reduce my cortisol as much as

01:29:49 possible from the week. ANDY GALPIN: There you go. ANDREW HUBERMAN: And then Sunday is the day that I enjoy that low cortisol state. And that's actually what opened up into the long, slow run. ANDY GALPIN: Amazing. ANDREW HUBERMAN: I actually like to think of myself as a bit of a mule during those long runs. ANDY GALPIN: Yeah. ANDREW HUBERMAN: I actually have a shirt that has a sloth on it that I wear to remind myself to go slowly on those runs. Not that I ever run that fast. But there's the whole mindset around

01:30:12 it is to be a bit of a mule, just kind of moving through it. And the fatigue factor is more one of at first there's just a little bit of boredom. But then, I've noticed, there's a whole different set of mental scapes that open up under different training types. And this is maybe something we get into a little bit in a future episode or discussion. When you train really intensely for short periods of

time one way, your mind goes into a particular state. When you do long duration training, you're thinking and indeed even the way

01:30:41 it affects sleep patterns is also very different. I think one of the great futures for neuroscience and exercise science in collaboration is to identify how different patterns of physical movement relate to different patterns of thinking and vice versa. ANDY GALPIN: Amazing. ANDREW HUBERMAN: Anyway, something maybe to just earmark for a future conversation. But there's clearly a relationship there. ANDY GALPIN: Yeah. Well, when we certainly know of a pretty clear relationship between even what we would classify as zone five exercise

01:31:09 and deep sleep. ANDREW HUBERMAN: So a zone five again being you're breathing a lot through your mouth because you have to in order to bring in enough oxygen to offset the acidity created by-- [LAUGHTER] ANDY GALPIN: The carbon. ANDREW HUBERMAN: Exactly. ANDY GALPIN: Yeah. This is the high heart rate. So I mean, if you're going to look at it and hit a number, looking for something like 30-plus minutes a week being in the top 10% of your heart rate. ANDREW HUBERMAN: That impacts deep sleep. ANDY GALPIN: Is going to positively impact

01:31:36 deep sleep, as long as it's done very far away from deep sleep. So you don't want to do that at night. So you want-- in terms of time. So if you hit those numbers earlier in the day, oftentimes that will enhance deep sleep. ANDREW HUBERMAN: Yeah, I was looking at some papers recently. And the number that emerged from those papers was that unless it's low intensity exercise, trying to exercise about six hours or more away from your sleep time would be ideal. ANDY GALPIN: Bingo. ANDREW HUBERMAN: Now, that said, for those of you that

01:32:05 have to hit the gym or go for a run in the evening and then are trying to fall asleep four to six hours later, I wouldn't want that statement to impede your regular exercising. ANDY GALPIN: Yeah. there's an easy trick to that. Just finish it with down-regulation breathing. So that's one of our things, that if you-- because that is a realistic situation. ANDREW HUBERMAN: Right. Finish work at 5:00, or even 6:00, and then by the time you're training or running or whatever you want to call it, it's a 7:30, 8:00, you're home at 9:00.

01:32:33 You're eating, and then everyone's like, you can't eat two hours before bed. Pretty soon you run into a number of different collision points that make you wonder whether or not you're doing everything wrong or if it's really worth training at all. ANDY GALPIN: 100%. ANDREW HUBERMAN: Now, I would argue it's better to train than not to train. ANDY GALPIN: Yeah. ANDREW HUBERMAN: But provided that you can still get to sleep. ANDY GALPIN: 100%. So you have to walk a little bit of a game. We run into this issue with the NBA players.

01:32:51 You're playing games at 6:00 at night that start. Major League Baseball is a 7:05, 7:10 pitch, right? ANDREW HUBERMAN: That's right. ANDY GALPIN: And also, by the way, we're changing time zones every five days. UFC fighters and such, were usually training twice a day. There is no option to train, or I mean, we are training twice a day always. So we have to come up with strategies for that. And there's other non-athlete scenarios, of course, where it's like, there is no other option here. Cool. So what we do is a couple of things.

01:33:18 Number one, the further away you can make it from sleep, the better if possible. We do need to train, though, around the same time you're going to be playing. That has to happen. So the harder and longer we go in the training session, the harder and longer we go in our down-regulation post-exercise. And that is, in my estimation, the number one lever you can pull that can help. Now, if it really does start crushing sleep, you're going to have to make a critical decision there. In general, it's not a good reason to not exercise.

01:33:53 But maybe you restrict to only a couple of days a week you go all the way up in intensity. And the rest of the days maybe 70%, you stay in this kind of a working zone. Awesome. Maybe it's a longer down-regulation. Maybe there's other strategies you can do. But yeah. You want to be careful of-- and we've had this situation a number of times where it's just sleep complaints, sleep complaints, sleep complaints. We run full sleep studies on them in their house. We do the whole thing with absolute rest.

01:34:23 We come in. We do the whole thing eye tracking, biomarkers, the whole thing. And it's like, oh, you just need to stop doing intervals at 8:00 PM. ANDREW HUBERMAN: And I would add to that, another incentive for being able to train with or without caffeine is that it's very clear that even if you can fall asleep after ingesting caffeine in the preceding hours that caffeine consumed in the, gosh, even 12 but really eight to 10 hours, four hours prior to bedtime really disrupts the architecture of sleep.

01:34:53 So if you critically rely on caffeine in order to train, whatever your training might be, and you know that sleep is important for recovery, well, then it's pretty obvious where I'm going with this. ANDY GALPIN: Yeah. ANDREW HUBERMAN: So having that flexibility is vitally important. ANDY GALPIN: Yeah. You've probably also covered this. But you can actually measure that directly. So by eye tracking patterns, you can actually identify the effects that caffeine has on sleep independent of sleep time or not.

01:35:18 ANDREW HUBERMAN: Right. There are never positive effects. ANDY GALPIN: Correct. ANDREW HUBERMAN: That said, I am a proponent of caffeine early in the day. And caffeine does have a lot of-- well, it's anti-neurodegenerative. As long as you're not getting anxiety, it's pro-performance, both mental and physical performance. But, of course, if you do not need

caffeine, if you're one of these mutants that do not need caffeine in order to go about your daily living with focus and intensity, then, by all means,

01:35:47 don't start taking caffeine. ANDY GALPIN: I'm not the hugest fan. I am scientifically. 100% or more. Personally, it does-- I don't do well on it. ANDREW HUBERMAN: Well, you seem to ride a little bit more what we would call a sympathetic tone, shifted towards more alert. I tend to be naturally a bit more like my bulldog Costello was, a little bit more on the mellow sleepy side. And caffeine just puts me right at that alert but calm place. And I can get away with drinking it-- I wouldn't say a ridiculous, but a fair amount of caffeine

01:36:17 and remain there. But I do restrict it until the time right up about 2:00 PM at the latest is really when I were trying to drink caffeine. Number seven. ANDY GALPIN: Great. So number seven and eight are pretty simple. This is now choose the intensity and the volume. So we've discussed those at length in the previous episodes. We probably don't have the time to go back over all those details. So remember the adaptation you're training for and pick the appropriate rep range, total amount of sets,

01:36:45 as well as the intensity to then get the corresponding adaptation. All you have to do is select those things. In terms of progression through a week, the rule of thumb we say for intensity is something around three 3% per week. For volume, it will depend on what you're doing a little bit, but any time you cross more than 10% per week, you're going to start running into problems. So I like 5% better. It doesn't need to be as low as three. You can jump up much more than that. 5% to 7% is better. So if you are doing, say, running,

01:37:23 because the numbers make it easy, and you're doing 10 miles per week total. And if you were to go up to 11 miles the next week, great. You're right around 10%. But what you wouldn't want to do is say, I'm running 10 miles this week. And I did maybe four Monday, three Wednesday, three Friday. So four, three, and three, you got your 10. Then you wouldn't want to add a mile every day. So Monday, instead of doing four, I did five. Wednesday instead of doing three I did four. Friday instead of doing three I did four.

01:37:54 What you actually did is you went from 10 to 13, which is a much higher jump than the 10% prescribed. So the same thing would be true for lifting weights. The same thing is actually true for calories and trying to add them, et cetera. So the body tends to not handle those things as well jumping more than 10% per week. ANDREW HUBERMAN: So keeping with this idea of increasing progressive overload, being 10% more over some period of time, am I correct in assuming that I want to identify one, maybe

01:38:24 two meaningful variables and progressing that or those variables? ANDY GALPIN: So progressive overload can come in the form of any of the modifiable variables. So you could increase the complexity of the movement. You could increase the intensity or the load. You can increase the volume by either more sets, more reps, or more total exercises in a day. ANDREW HUBERMAN: What about time under tension? ANDY GALPIN: You can also manipulate how-- the tempo of each repetition. You can also manipulate how many times per day you train.

01:38:55 So you can manipulate frequency. You can also manipulate rest intervals. So you can progressively load any of these things. Increase intensity. Run a little bit faster. Complete the same amount of work slightly faster. Put 5% more on the barbell, or the load, or the handle, or whatever you going to do. That's the simple way. If you want to think about volume, in the case of endurance work is simple-- mileage, time, whatever. In the case of lifting, all you have to do is take the amount of repetitions

01:39:27 you're doing per set, multiply it by the sets, add that all up. So if you're doing three sets of 10, that's 30 repetitions. If you did three exercises, you just did 90 repetitions. Put that number down for Monday. Put that number down for Wednesday. Put that number down for Friday. Add that total up. So say you did 90, 90, 90. You would look and say, my total number of repetitions this week is 270. If I want to go up 5%, then I need to go up another 15 or so total repetitions. Great that's all we have to do.

01:40:00 That's the increase. You may keep the load exactly the same, keep the exercises the same, change nothing else. But you want to add 15 more total reps for your week. And you may choose to do that by adding one more repetition per set. Close enough. So last week I did three sets of 10. This week I'm going to three sets of 11. It can be as simple as that. Again, it can be complex. I walked you through-- it can be any of the modifiable variables. But the progression I just laid out is fairly simple,

01:40:26 and it's honestly the one I recommend for most people, just because it will avoid confusion and it will avoid people taking massive leaps in volume. So the typical strategy I would recommend here is increasing load or intensity, or a little bit of a combination, slowly for about six or so weeks and then taking what we generally call a de-load. So back down to maybe 70%. Whatever that number is you've been doing. So you did three sets of 10 and you worked yourself all the way up to three sets of 15.

01:41:01 Back that down and maybe we'll do two sets of eight for the week. And then we'll come back the following week and go back and do the highest we've done. Now we're all of a sudden we're going to do four sets of 12 or something like that. So if you get these little de-loads every-- depending on what you're doing, four weeks or so-- you should be in a spot where you can

continually progress for a very long time without either burning out or overloading, and overstressing, and injury pattern. So the simple way, pick intensity or volume.

01:41:33 And just go up slightly every week for a short span of time, generally around six weeks. And then you come back and change your strategy if you'd like. ANDREW HUBERMAN: Because you mentioned sets and repetitions here, I just wanted to remind folks that in the episode that we did on strength and hypertrophy-- and that also included speed-- there was a description of a terrific program for strength, which is the three by five program, or three to five program, as it's called, which is to select three to five exercises performed

01:42:02 for three to five repetitions three to five times per week with three to five minutes rest in between those exercises. ANDY GALPIN: For three to five sets. ANDREW HUBERMAN: And if I recall correctly, the protocol for generating hypertrophy, muscle growth, is to perform a minimum of 10 and probably more like 15 to 20 sets per muscle group per week. And that can be done in a single session per muscle per week. So one could train, for instance, quadriceps one day per week, as long as you're getting that volume of sets per week.

01:42:34 Or it could be divided up across two or three different sessions for that individual muscle group. Of course, people are going to target all their major muscle groups and hopefully some of the minor muscle groups as well. And as I recall, the number of repetitions that can generate hypertrophy is quite broad, anywhere from six repetitions all the way up to 30 repetitions. But by the end of the set, it should be to failure or close to failure with good form. Is that correct? ANDY GALPIN: Yeah. And we would say, close to failure

01:43:04 is probably most appropriate. You can actually reach failure maybe on a few of the sets, maybe the end. And probably best to choose that with the exercises that are safer, not that any exercise is particularly unsafe if you do it appropriately. But you may not want to go to true failure on every set for the more complex, larger, riskier exercises. So hedge pretty close to failure, but not all the way. ANDREW HUBERMAN: And I realized I forgot to mention rest intervals between sets. It follows that if a large range of repetitions

01:43:43 are performed that a large range of rest intervals are allowed, meaning that there could be rest intervals between sets of as low as 30 seconds between sets or as high of two or three minutes, depending on the loads that one is using. And that, of course, will scale with the number of repetitions. ANDY GALPIN: Excellent. In fact, that leads me into step number nine of designing your own training program, which is you've decided on a goal. We've worked our calendar out. We've figured out how many days per week

01:44:12 and how long we're going to work out in those sessions. We then went and selected our exercises. We balance them across the movement patterns and the muscle groups that we need so we're not causing excessive stress on the same exact joint or muscle group over time. We then ordered our exercises based on priority. Because of that, we've identified our goal. We went back and we selected the volume, which is the repetitions per set, the total amount of sets, and the load per set that matched the goal that we wanted

01:44:42 to get or the adaptation. Now, all we have to do is fill in the rest intervals, which reflect back, again, the goal. So generally higher rest intervals, which means time that you rest between your sets. Higher somewhere between two to five minutes for things like speed, power, and strength. Perhaps a little bit lower, although as you mentioned, it could also stay high for hypertrophy. And then for endurance, you follow the rest interval that reflects the type of endurance training that you'd like to get.

01:45:12 That's walked us through one through nine. We're almost done. We've put together a pretty nice little protocol. It should be well rounded. It should be effective. We've also talked about how to progress it from week to week, keeping it within, again, four to six weeks, maybe up to eight before we then take a back-off. The very last thing we have to do to make sure this training program is customized to you, your goal, and your situation, which is then going to enhance your likelihood of adherence and consistency,

01:45:41 as well as increase the likelihood of effectiveness is, we just have to do a little bit of what we call chaos management. Which is take a quick moment to think through, this program looks great. But if I had to nitpick it, where are the possible chances of failure? And you just want to think about where would I predict things would go wrong? And if anything pops out to you. Try to come up with your solution at the beginning. And this could be a number of things. So maybe you've picked an exercise

01:46:15 and you realize, man, I really actually don't like that exercise. Or maybe you look at the schedule now that it's laid out in front of you. You look at your work schedule. And you're like, ah, maybe that's a bit aggressive. I don't know. It could be any number of things. But it is a useful exercise to just think through everything realistically. I typically just-- it's the adage I teach my graduate students-- before we hit Submit, we're going to sleep. So it's there. It's ready. We're going to take 12 hours.

01:46:41 We're going to wake up the next day and look at it again and go, are we sure we're good here? Yep. Make adjustments if you need. If not, if you feel confident, then hit send and cross your fingers. ANDREW HUBERMAN: Yeah. We were referring to submitting the manuscript. It's interesting you say that. I have a statement that I always make to people in my lab. They hit Submit,

and they always say that you realize you're going to wake up tomorrow morning. There's going to be an email in your inbox that something was formatted incorrectly

01:47:06 and you're going to spend tomorrow reformatting and submitting again. So I've also learned that every project is actually two projects-- ANDY GALPIN: I'm sorry. I'm trying to not die over here and interrupt you. [LAUGHS] It's true. You have no-- ANDREW HUBERMAN: Yeah. It's true. I've done this enough times. I've done this many dozens of times. And then there's also another truism of science which is that there's the project, there's the scientific question. And then the paper is yet another project.

01:47:31 And I actually think this is an analogy that carries over to other domains of life. I think that any time we take on something, if we want to write a book, or we want to get a degree, or we want to do a fitness program, I think it's worth thinking about those decisions as actually to taking on two major things. Because one is the planning and organization around that thing. And the other is the actual performance of the thing. ANDY GALPIN: Wonderful. ANDREW HUBERMAN: And so, I say that, because here what

01:47:55 you just described, this 10 steps to consider in designing a program, I think some people who are real list makers and love the precision and the thoroughness-- and I'm one of these people-- thinking, this is great. I just want to check off each one of these things on the list and figure out the ideal program for me for a given period of time et cetera. And then other folks might be thinking, well, that's a lot. That's just a lot to do. But what I know with certainty is that performing those sorts of, let's just call them

01:48:25 what they are, those tasks of figuring out what's what, where the defenders are, et cetera, without question makes everything go so much more smoothly once you are into the actual performance, the action of doing the exercise program, or the book, or the podcast, or whatever it is that you happen to do. So I'm grateful that you brought up both the things that act as conduits for getting good work done and this notion of defenders and bottlenecks. Because we don't consider those, I would argue that it's a very low probability

01:48:59 that anyone will succeed. But when one does consider those, even just a few of them, I think the probability of success goes way, way up immediately. ANDY GALPIN: That's actually a very good point. That is a lot of work for a lot of people. And I know when I'm consuming information, it is helpful to hear structure, and systems, and design. It's also helpful to hear actual real-life examples. So maybe the next thing we can do here is I can just walk you through an entire setup and a program considering folks that are in bucket A, B, and C.

01:49:33 And maybe I'll save a little bit of the explanation. And we'll eliminate maybe some background. And I'll just walk you through what this could look like. All right. So I created a program which should run about a year. And the idea here is that this could be an evergreen system. So one could check off all the boxes that we've talked about. So in general we want to have three primary goals with exercise. We want to look a certain way, whatever that means to you. We want to be able to perform a certain way, whether that's

01:50:06 for life goals, like hiking and energy, or sport goals, or whatever. And then we want to be able to do that across our lifespan. So a program that gives you all the goals we talked about, and a program that covers that health combine that we referred to way back in some of our earlier discussions, which as a little bit of a recap is, what are the physical fitness parameters that we know are critical to maintaining both lifespan and wellness span? And as a bit of a reminder, those are things like your grip strength, your leg strength,

01:50:41 your total amount of muscle mass, your actual speed and power so that you can catch yourself from a fall, your VO2 max, and your physical fitness. So I want a program that does a little bit of all that. It's similar, actually, and we're kind of crossing barriers between our three buckets. So I need to be able to control my fat. I need to be able to have enough muscle. That muscle needs to have enough function. And I need to be able to maintain range of motion so that I don't lose flexibility and get hurt.

01:51:11 And then I need to have a good VO2 max as well as to be able to sustain energy over time. So that was the goal of my progress. Now, a couple of other things that we haven't chatted about, which are very important. You have mentioned, I think, on a previous podcast about the importance of seeing light? Is this something you've covered at one point or another? ANDREW HUBERMAN: Yeah. I joked that I'll be going into the grave and they'll be shoveling dirt onto me and I'll be telling people what I'll tell you again now,

01:51:38 which is to get five to 30 minutes of sunlight viewing as early in the day as possible, ideally from sunlight. But that's why it's called sunlight. Or from bright lights of another kind if you cannot get sunlight. And also get that in the evening. And then avoid bright lights between the hours of 10:00 PM and 4:00 AM, unless you do shift work, in which case, check out our episode on shift work. ANDY GALPIN: [LAUGHS] Amazing. So we've got a little bit of a juxtaposition where people are like, I need to work out and do

01:52:03 all this training. But then I'm also supposed to be outside. How do I blend those two things into my training program? Cool. So I checked that box as well. I built that in. The last thing here is we've talked about structured exercise. And just in this episode, we've really opened up and do non-structured exercise-- hiking, sports, things like that. Well, one thing that is incredibly clear--

and my colleague and friend, Tommy Wood, at the University of Washington, published a fantastic paper very recently on the importance of proprioception

01:52:35 in maintaining and staving off late onset dementia and Parkinson's. ANDREW HUBERMAN: Maybe just to remind people what proprioception is. ANDY GALPIN: Yeah, absolutely. So there's structured exercise. And that's very important. But then there's also things like balance, and coordination. And proprioception meaning you're adjusting to stimuli coming in from the outside world. So this stimuli could be sound. It could be light. It could be smell. Or in the physical case of the body, it is where you are at in space.

01:53:03 So I'm feeling like I'm falling to the left. Therefore, I need to correct and move back to the right. So you don't get this with doing things like a hack squat on a machine. You get this typically from being outside. So now you're smelling and seeing things. And you're also not landing with your foot in the exact same position on an even platform. We get this from things like sport. Now I'm not only exercising, but I'm reacting to the outside world. The ball is going over here, my opponent's going over there.

01:53:31 So it's very important, in my opinion, to have at least one session per week of exercise in which you are doing something that challenges proprioception. So how do I fold all of these best practices into one training program that's not 200 hours a week seven days a week? That's what I've laid out to you. Make sense? ANDREW HUBERMAN: Makes sense. ANDY GALPIN: Cool. Let me walk you through it. And then, maybe we'll come back into each individual category and you can ask questions about them. So the way that I think is best is to have a goal.

01:54:06 And have that goal be around eight to 10 weeks long, like we've been talking about. So what I gave you is, let's start off with quarter number one of the year. So perhaps January through March or so-- and it doesn't have to be this long, but just as an example. You decide your goal is going to be to put some muscle mass on. So we're going to prioritize adding muscle. Now, within that, you're going to be bulking up, adding some muscle, but we're also going to be sleeping more. We know we need extra recovery in this session.

01:54:35 And we need to go up in calories. Now, this happens to work nice for a couple of reasons. But in that protocol, maybe we're going to do seven days or seven sessions a week of physical activity. Doesn't mean seven days. But maybe those sessions are something like I will do one indoor sport. This could be basketball, could be any number of things. So I got my sport ticked off, and it's indoors. Why? I'm in January to March. The weather's probably not great for most of the world. So I'm not going to do as much outside activity.

01:55:08 I'm going to do weights maybe three or four times a week, and then maybe two days a week I'll go for a long walk. Again, we'll come back and I'll explain to you why I made all these individual choices so you're going to run that for the first quarter. At the end of this quarter you're going to take a de-load week. Now, this could be fully off. Maybe this is when you schedule a vacation. Maybe this is backing off. Maybe you just keep your walks in and you spend the extra time on your family, or work,

01:55:32 or whatever else we need to do. So we've bulked up a little bit. We spent 12 weeks adding some mass. Now we're going to transition into quarter two, which is where we start to actually get lean. This is actually a pretty standard bodybuilding template, which is put on some mass first, and then you get lean after that. So now we're going to get lean from April to June. We're going to bring calories down a little bit. So now we're actually going to play in a hypocaloric caloric state somewhat. The days tend to get longer.

01:56:03 So we're going to have more time to spend in the sun. So we're going to shift a little bit from an indoor sport activity, like the example I said earlier was basketball, to maybe stand-up paddleboarding, or some other thing where you're actually getting your sport done, you're reacting, you're using proprioception, but now you're getting that sun in there as well because you have a greater opportunity to actually do so, and the weather probably is going to cooperate with you more often than it would

01:56:27 in, say, February. You then maybe going to pick a fitness or an exercise class. Any number of routines where you're with multiple people. And then, two days a week in addition to that, you're going to maybe lift some weights. So now, we've added some muscle. Now we've got lean. And all of a sudden, we're actually looking pretty good for the summertime. Hmm. Interesting. Quarter three, July to September, we'll transition, and we'll try to get into great cardiovascular shape. So we'll transition more into some high intensity interval

01:57:03 type of stuff more frequently. We're going to maybe stay at maintenance calories now. We spend a little bit of time hyper, then we went hypo, and now we're going to go back to maintenance and keep along. We're going to continue to choose some outdoor sports, but maybe you change it up. Maybe you keep the same one. Maybe now we switch it out on the golf, or now we pick a pickleball, or we play basketball, but now we just do it outside. Any number of things you can do. So maybe even we do a couple.

01:57:29 Change it up. You do that twice a week. You're spending more time in the sun now. You're looking outside and you're seeing this great weather and you're not cooped up in a gym but you're getting your physical fitness in. That's also going to be aiding in your high intensity or your interval, your conditioning, because you're doing more stuff like that rather than lifting in a gym. And

then, maybe you're actually going to do some track workouts. Maybe we'll do this on a bike, or we'll do some hill

01:57:52 sprints outside, any number of things. And then we'll do that maybe twice a week. And then we'll still lift weights twice a week in our gym. The last quarter then is going to be October to December. And we're going to transition there into more pure cardiovascular fitness. Because we're doing that, we're going to be working harder. And remember, cardiovascular training is generally expelling much more calories than lifting. So we're going to actually go up in calories. We're going to return to that.

01:58:24 And that works out kind of well, because I don't know if or not, but people tend to eat a little more calories from the months of, say, November through December. ANDREW HUBERMAN: Yeah, holidays, and at least in northern hemisphere, colder temperatures. ANDY GALPIN: Totally. Maybe even we play with two workouts a day here. We're trying to get really in shape. We're trying to improve our conditioning and our endurance in multiple areas. We're going to actually transition back into an indoor sport.

01:58:49 So maybe we're going to do some kickboxing, or a jiu jitsu class, or something like that. We're going to maybe hit the cardio machine once or twice. Now we're hopping on a StairMaster, a VersaClimber, more maybe get an assault bike going, something like that. Maybe hit some machines and do our lifting there. Maybe we spent the rest of the earlier part of the year on barbells and dumbbells. We'll transition to some machines. And then we'll still try to get outside and walk twice a week. And that gets us our outside activity,

01:59:18 but it's not necessarily a structured program. So we've got 15 minutes where the weather's breaking a little bit. So let's walk, get outside, and get a walk in. So that's the overall structure of everything. I would like to actually go back to the beginning now and walk through each one of these things in detail and explain why I chose certain things. I've kind of given some hints already. But I think it'd be helpful to walk back to the beginning and start there. ANDREW HUBERMAN: Great. I of the overall structure.

01:59:45 I have just a couple of questions. The idea of training mostly for hypertrophy January through March makes sense. Followed by a period from April through June focusing primarily on fat loss. And then from July to September, speed and interval type work. And then October to December, you put to emphasize endurance type training. I thought for a moment that when we got to October, December, you were going to emphasize strength. And I'm wondering whether or not there's any incentive for training for strength October, December,

02:00:26 so that when one arrives at the hypertrophy training January through March, we're that much stronger. The idea being then there's more muscle to hold on to as one then tries to lose fat from April through June. And then July through September is the speed work. Or is July through September the speed slash power phase of the program? ANDY GALPIN: The July through September would be more like your higher heart rate, learning to get all the way up, maximum exertion, and then recovering. ANDREW HUBERMAN: An October to December

02:00:58 is long-form endurance? ANDY GALPIN: Moderate to long-form. So it's closer to that aerobic capacity stuff. It is closer to longer duration and moving through that spectrum. You are astute in pointing out that I didn't have pure strength really in there. You certainly could fold it in. But quite literally, if you spent three months bulking up in January to March, that's going to bring some strength along the way. So you should be fine there. But you absolutely could alter any of these variables if you want to emphasize something more than other one.

02:01:30 So say you actually felt like you ran through the fitness testing. And you identified, actually, your endurance is pretty good. But you're struggling maybe with a little bit of strength and maybe a little bit of lower muscle mass. You could substitute quarter three or quarter four and say, one of those quarters will be strength. And then I'll do all of my conditioning in another quarter. And what you've really done is the programming is still fairly simple. You've just altered the priorities a little bit.

02:01:56 And therefore, you've altered the adaptation across the year. And why this is really important, this template is meant to be something you can just run back year after year after year. And you make a subtle change like that. And now, over the course of five, 10, 20 years, you're going to be in a fantastic spot at the end. So you can make easy adjustments along the way as priorities pop up, as goals pop up. But you're going to be in a position where everything is-- there's nothing that's going to be lagging behind.

02:02:25 You'll be in a good spot. Most of your bases are covered to be pretty lean, have a good amount of muscle, and to be in great shape. ANDREW HUBERMAN: Two other questions. One just a quick question. For sake of generating proprioceptive feedback-- during the endurance phase, is trail-running a good option? ANDY GALPIN: Absolutely. ANDREW HUBERMAN: Great. Thinking back to the days running cross-country. It's October, December, you're trail-running. ANDY GALPIN: Totally. ANDREW HUBERMAN: Training for endurance.

02:02:52 ANDY GALPIN: The ground is not super solid, which is even better in this case. So you're making more choices and trying to not fall on your face. ANDREW HUBERMAN: Absolutely. And then you mentioned bulking up. And I just wanted to highlight that there are some folks, myself included, while I'd like to add a little bit of muscle here or there, I'm not interested in overeating to

the point where I lay down a lot of body fat stores along with that. ANDY GALPIN: Sure. ANDREW HUBERMAN: And I think a lot of people out there

02:03:18 are not necessarily interested in, quote unquote, bulking up. I also-- my understanding of the literature-- and tell me if I'm wrong-- is that while there does need to be some sort of caloric surplus above what is required to maintain body weight in order to build muscle, that many people who try and, quote unquote, bulk up basically just end up expanding the size of their cheeks and face along with their limbs and torso. [LAUGHS] ANDY GALPIN: Yeah. ANDREW HUBERMAN: I'm not trying to poke fun at them.

02:03:50 But the idea of deliberately overeating to the point where a lot of body fat stores come along, I would imagine that would just make the April through June phase that much harder. ANDY GALPIN: Correct. ANDREW HUBERMAN: And I'm not sure it's ever been studied directly. But I can't imagine it's all that-- excuse me, all that healthy, to bring along a lot of adipose tissue in one's pursuit of hypertrophy. ANDY GALPIN: You're absolutely correct. We have not gotten into the nutritional details there.

02:04:16 But yeah, thank you. Good clarification point. A couple of things. You're not going to be doing this very long. It's 12 weeks. We're not going to be six, seven, or eight months. ANDREW HUBERMAN: You haven't seen me eat. [LAUGHTER] ANDY GALPIN: Number two, just since we're here to clarify, the literature is ongoing in this area. And there's actually a handful of studies that I know are coming soon. But in general, when I say hypercaloric here, I'm referring to an increasing caloric intake above baseline

02:04:43 by something like 10% to 15%. So if you normally eat 2,500 calories throughout the day, you might add another 250 to 400. I'm not doubling calories. I don't want you to be stuffing your face, hating food, feeling awful all day, and then putting on half of your weight as fat and half your weight as muscle. It is just technically hypercaloric because you're eating more, which is an absolute requirement for most people to add muscle. Some folks who have a high percentage of body fat and a low level of fitness training

02:05:20 can actually get away with just being either isocaloric, technically, or even a little bit lower, and still adding some muscle while losing some fat. But for most folks, that's going to be challenging. So you're going to want to be in a hypercaloric state. Another reason I put it in here is because, remember, people tend to make these extra calorie choices during this part of the year anyways. And so, you're playing into life is why I chose that. It's like, hey, you can't restrict calories all the time.

02:05:51 It's really, really hard. So maybe if we can put it calorie restriction during the phases of the year that's a little bit easier, and give you the freedom to have a little bit more calories during the phase of the year when you're probably going to want to do that anyways. Just make sure you're doing a style of training that supports that. So you're going to be trying to add muscle when you know you're going to be adding more calories. We're going to be trying to really push the pace on our conditioning when

02:06:15 we know we're going to be eating more calories anyways. And so, that is actually, in fact, exactly why I chose those goals for those times of the year. It's because we're now playing into life a little bit more. But we, again, certainly do not want to be eating to an excess or where it's causing some of the problems you mentioned. We just need to be eating a little bit more. The last point here is, the next phase, April to June, we know we're going hypocaloric. So it's always kind of nice to go, yeah,

02:06:45 we're going to go in a little bit of a calorie deficit here. But it's really just these few months. And it's OK, because I spent the last six months where I wasn't restricting that much, and then one actually where I got to eat a little bit more. And now, cool, not hard for me to convince somebody that to go we're going to bring the calories down right now, or in a month, in two months. And it's just going to be this 12 or 16-week phase, or whatever you end up being in there. So those were some of the rationale

02:07:10 that I was thinking of when I decided to do that. But thank you. That's a very important point in terms of the hypocaloric. It's not the dirty bulk. It's not the excess that a lot of folks will do. ANDREW HUBERMAN: And just a final point for folks in the Southern hemisphere, Australia, and South Americans. ANDY GALPIN: Ah, flip everything. ANDREW HUBERMAN: We actually have a large listenership in the Southern hemisphere. Of course, adjust accordingly. Even though the holiday months are still in November, December, there are, of course,

02:07:37 holidays all year long. ANDY GALPIN: Of course. You got Fourth of July. ANDREW HUBERMAN: Many, many of the major holidays are around November, December. But it's summer down there. Just adjust accordingly. There's nothing holy about trying to achieve certain adaptations at certain times of year. It's more about trying to eliminate bottlenecks, defenders, as you mentioned. And it's really about the sequence. ANDY GALPIN: So if we go back to that first quarter, we're going to try to add some mass, for the reasons

02:08:03 I just described. It's also tends to be pretty motivating. You're going to start the year off. You're going to want to train and get all excited because of your New Year's resolution. And you're going to see results immediately. We've talked about this in some of the previous episodes. The nice part about hypertrophy training is you see your muscles growing right now. Where the

endurance stuff tends to have a little bit more of a delayed gratification. So I'm going to give you a win early. Now, we're also going to be sleeping more.

02:08:31 Because we know-- and maybe we'll get into this in a future episode-- that sleep is absolutely critical to recovery and critical to growing muscle mass. So you're going to emphasize sleep more during this part of the year also because the sun is very low. It's harder to sleep for a lot of folks longer when the sun is out for longer, especially if you don't have a perfect blackout curtain. And so, you're just trying to play with the restrictions life gives you and optimize your scenario. So the sun's probably not out very often.

02:09:01 And especially, depending on where you live, if you're anywhere like where I grew up in the Pacific Northwest, [LAUGHS] it's going to be dark, and gray, and gloomy most of the day. So it's not hard to convince you to go sleep a little bit more often. So we'll do that. That's also, again, why I chose an indoor sport. That activity, you're going to not shoot yourself in the foot. Being in the gym when it's cold and crappy outside is not that hard to convince yourself to do. So you're going to be lifting your weights, say, four times

02:09:29 a week. And then, again, getting some outside time in the form of a walk so that you can do it in the middle of work if you have to, or catching 20 minutes here or there, whatever it needs to be. The chances of you missing that walk are little. And you'll still get some outside time. You've talked about the importance of getting sunlight in even if it is overcast. So you can still nail all those boxes and be in a pretty good spot at the end of that quarter. So moving on to quarter two then, April to June.

02:10:00 A lot of people want to look good during the summer months. You're more likely to be outside. You're more likely to have your shirt off because it's hot, because you're either on vacation, or going to the beach. So let's play into that a little bit. Let's let people look a little bit better, if that's what they determine to be looking better, during the months when they're more likely to have that. You're also more likely to have things like weddings over the summertime. People don't get married often in the winter.

02:10:27 And so, people want to look good for these events. So let's play into what a lot of people already want. And let's help you get leaner. Not a lot of holidays that involve eating during that phase. And so, you're not going to feel like you're missing out on a ton of life outside of maybe a few smaller holidays in that phase. The days are getting longer. And so, we're going to choose to get in the sun more often. We can start getting a tan better. We can start getting ready for summer. And so, that's is why we exchanged our indoor sport

02:10:58 for an outdoor sport-- surfing, hiking, cycling outside, whatever the thing is you want to do. There's tons of them. Kiteboarding, like I said, skateboarding-- there you go. Get out and start skating a little bit, whatever it needs to be. So we'll do that once a week or so. And then I actually threw in a fitness class here. And there's a couple of reasons. One, now it's sort of nice to take the pressure programming off. It's also nice to, if you've been lifting by yourself, to get in there and lift with somebody else.

02:11:30 It's also nice to now have some social interaction. The gamification, the group, the scoring stuff that happens in fitness classes is very, very powerful. It tends to be somewhat fleeting. So it won't last for a long time, for some people, others it does. And so, if you pepper this thing in and you know you're going to join this activity class, even if it's not great and the program design isn't perfect, it's fine for 10 weeks. In fact, you may really, really enjoy it. And also, again, it gives you something new to think about.

02:12:04 Music is on. You're out of your house if you're lifting at your house. You're in a different part of the gym. The schedule is a little tighter. So you can't just go work out whenever you want. You've got to show up when the class is going. And you'll probably find that you just love it. You also get some social interaction, which is something that's also very important that we haven't really discussed yet, if you're out playing basketball by yourself or whatnot. So this is just another thing I'm

02:12:28 trying to fold in that still allows you to check off multiple boxes of things that are healthy for you. You've had episodes on the importance of social connection interaction. We talked about that in the quad breakdown of making sure you have relationship time and things like that. So throwing in a fitness class and just doing, honestly, something quite different is pretty fun. But then, still, keeping two days a week where you're doing a traditional strength training thing so you have some quality control there.

02:12:56 Lastly, you can also then make sure you're hitting any specific movements or muscle groups that are very important to you. So you don't get to control that in your fitness class. But now you can at least do the gym and make sure you hit that muscle group that you have an interest in it. So now we're feeling pretty good. We're rolling into the summer. We're pretty lean. We're getting out in the sun a lot. We're bringing calories down a little bit. And we probably are feeling pretty happy. We're also not burnt out.

02:13:24 We've done a lot of fun things. And we've checked a lot of the boxes off for long-term development. We had a combination of specificity with exercise selection. But we also folded in just a little bit of variation so we don't have to worry about overuse injury of doing the same machines, the same lift, months, and months, and months, after months, and slowly wearing down

something if our technique isn't perfect. So now we're going to go into our quarter three, which is the summer months, basically, up here

02:13:54 at least, July to September. We'll transition. It's been a while since we've done some conditioning. So we may have lost a little cardiorespiratory fitness. We may have-- not feeling great anymore, maybe energy throughout the day stuff is starting to leak down. So we're going to get in shape. We're going to push our heart rate high. And we're going to bring the calories back up. The summertime, 4th of July, other holidays like this where eating is involved, maybe you're going to sporting events and things like that.

02:14:24 Our sport choices is often going to be outdoors. But in fact, what you'll notice here is, is I've ramped the sport choice up to twice a week. And in fact, I would encourage you to do two different types of exercise. And one of the primary reasons for that is to spend more time outside. A challenge we often see with people with exercises going, man, it's so nice outside. I can't go sit in the gym for 45 minutes. I don't have that much free time. And then, Huberman's over here telling me I need to get direct sunlight more.

02:14:55 How am I going to fit this in? Well, do your exercise outside. Enjoy it. Now, if you live down here like us, you take sunshine for granted. But a lot of people I know it's like, it's only nice for two and 1/2 months of the year. Get outside. So let's push more of our fitness training to outdoor activities. These sports can be intense or not. It could be go out there and swim hard. Get in the ocean. You're going to do open ocean swimming instead of swimming in the pool indoors, or whatever the case may be.

02:15:24 So we're going to give ourselves more of a priority of being outside, looking-- we've looked pretty good. We're a little tan. And we're enjoying all the benefits of training outside and the lack of structure. Still, we have structured, but not so specific like the machines and the weights give us. Maybe even now we're doing some track workouts. So now we can do something like sprint the straightaways, walk the corners. And we don't have to, again, do our conditioning on the same StairMaster, or machine, or whatever we're on.

02:15:53 So we're going to enjoy some stuff like that. We're going to be athletic. We're going to run. We're going to move. We haven't talked about that yet. Everything has really been about structured exercise. Well, now we're going to do some sprint work. We're going to get out and see that, which is a really important human quality that, I think, is important to not lose, is actually ability to sprint. So we'll do that. And then we'll still make sure we lift twice a week for the same reasons I talked about in the previous phase.

02:16:18 So we make sure we have some quality control there. We maintain some of the muscle that we built in the quarter before. We don't lose too much strength. There is very good literature to suggest strength maintenance can be done in as little as five sets per week for a very long time, really up to eight-plus weeks if you do a little bit. So you're touching it enough where you're not going to get really, really weak. But what you wouldn't want to do is go 12 or 16 weeks where you lifted no weights.

02:16:45 And maybe you got in great shape, but you're going to feel very weak after that. So maybe that number could come down to one time a week if you really wanted it to. But one to two days a week where you're lifting the big exercises, the muscle groups and movements of interest, and you're good to go. Then, lastly, we roll into our final quarter, which is October to December. And we're going to really get in great shape. The sun is starting to come down. We're rolling into the holidays. Weather's getting worse.

02:17:11 We may have other outdoor activities we want to do, like, in my case, you're going on a hunting trip, you have some travel, conferences, whatever the case may be. And so, we're going to choose an indoor sport. And I love combat sports. So the example I gave earlier was jujitsu. Or maybe you just transition your basketball to inside, or your pickleball comes inside, or whatever it happens to be. And you're still going to have that twice a week. And then, maybe instead of the track workout outside,

02:17:40 you do that same workout indoors, now back on some sort of machine or something like that. Our weights are actually now down to once a week because we're really pushing the pace on cardiovascular. We're doing once a week to maintain it, to not lose, and get too far behind. But we really want to bring up our VO₂ max. We want to bring up our efficiency, our cardiac output, and everything like that. And we're still going to now walk twice a week so that we get something outside. And I talked about why, again, it's

02:18:09 nice to have that flexibility of not having to train outside, because now you got to warm up and do all those things. We just get out and get a walk in. You still get the outdoor experience. So we run through that entire thing. And then you just start back the next year. Ideally, again, at the end of every quarter, you take a week off. Whether that is a true full week off, which I'm fully supportive. I mean, friends, we're only talking about four off weeks a year. That's absolutely fine. Or it could even be a slight de-load week

02:18:40 if you want it to be. So we shouldn't run into too many issues of overuse. We have a lot of variety. We get a lot of movement patterns in because we're mixing in sport with machines and dumbbells. We're mixing in social interaction. We're mixing in the sun. We're mixing in enjoyment. We're mixing in fat loss, strength, hypertrophy, some cardiovascular endurance. We're

mixing in calories in high, we're mixing a little bit of calories low. And we're trying to hit as many of these nodes as possible.

02:19:08 If you also wanted to cut each one of these a little bit short and repeat your fitness testing at the end of every quarter, you could. I would probably recommend doing it at least once a year. Perhaps doing it maybe the third week of December or so. So you run that testing. That's your last week of training. Then you get to go on your vacation break. You come back at the beginning of the year. You've got new goals, new targets and you go. If you want to repeat it twice a year, do the same sort of thing

02:19:38 at the end of June. It's fine. I know I laid these out as quarters, which is generally 12 weeks, with one back-off week. But if you wanted to make it nine weeks and a testing week, and then a back-off, or 10 weeks, it's fine. It's close enough. So the last little thing I want to say is, let's assume you're doing the 12 weeks. And you're going to have a back-off week at the end of the 12 weeks. I would actually still then recommend having at least one back-off week halfway through. So it would look like this.

02:20:08 Five weeks hard where you're progressing. You're going up, up, up, up, up. Every week you're either increasing volume intensity like we talked about a few minutes ago. Then week six, de-load. Go down to 70% volume intensity. Come back. Go hard for five more weeks. And now, week 12 is your true off week where you, again, take the whole thing off. If you do that, you now have four weeks a year where you're totally off. You have four weeks a year where you're really backing down. And you just have five-week segments

02:20:43 all year round where you're just going to push it hard for five weeks. You're going to get a break. You're going to reset, and you're going to transition a little bit. Now, as I started this conversation off with, there are many ways you could structure your training program throughout the year and hit those primary goals we talked about of looking fantastic, feeling amazing, and being able to do that your entire life. All I can tell you, though, is I know this model works. Because we've done this a lot with our clients

02:21:12 in our rapid health optimization program. And this spans everything from 25-year-old folks who are competing in the Boston Marathon to a lot of individuals who have never exercised before, who maybe have done a little bit of exercise. In fact, it's quite literally all three of the buckets you laid out. We've had clients in all of those areas, both men and women, young and old. And we've had a tremendous amount of success transforming their lives using a very similar model to what I just laid out.

02:21:43 ANDREW HUBERMAN: I find that overall structure to be immensely informative. And I'll tell you why in the context of a number of examples with myself, although that's the least important of them, frankly, but examples of family members of mine and friends of mine who've undertaken consistent exercise training programs but that haven't varied the program so much. And here, again, I think of the person who really loves to swim. They have a low barrier of entry to the pool or to the ocean. They love being in the water.

02:22:15 I am not one such person. I like being in the water, but I don't motivate to drive to the pool or to bike to the pool or to get into the ocean that often. Once I do it, I enjoy it. But for me it's running and lifting weights. And it has been for a very long time. I have a family member, close family member, who doesn't really like, quote unquote, exercise, but loves dance and dancing. Going out dancing, yes, but dance classes in particular. ANDY GALPIN: Amazing. ANDREW HUBERMAN: Really enjoys it.

02:22:39 Loves to be distracted from the fact that she's doing exercise and just really enjoys it. And actually is a very good dancer despite the fact that she's related to me. And on and on. There are many examples, I think, of folks that fall into the different bins that we talked about earlier but that also tend to default towards a given structure of training one way and doing that throughout the year. I can tell you right now that I'm personally going to modify my schedule according to this four quarters per year.

02:23:09 It actually works because I've mostly been on the quarter system in academics for a very long time. I was at a university that had a semester system once. But this quarter system is actually the one that we follow academically. So that's one reason why it's a natural fit for me. I confess that I typically don't vary up the proportions of endurance to resistance training. I tend to keep those about three and three across the week. Three resistance training sessions, three, let's call them cardio sessions.

02:23:38 But each one designed to achieve a different adaptation. And I've now altered those even further based on your recommendations in this episode and previous episodes. But what I have not done is to really think about de-load and to really stick to the structure that I set out to accomplish across the year. On the topic of de-load, for me, the de-load has been when I get overwhelmed with work, or I've gotten sick. I don't tend to get sick that often. But every once in a while I get knocked back with a cold or a flu.

02:24:13 Once every three or four years I seem to really get hammered with a fever-inducing something or other. And then I'm bedridden for a couple of days. And then I'm back at it. And I tend to come back rather slowly. And that tends to be my week off. But I'm beginning to wonder whether or not part of the reason I hit those streaks of being overwhelmed by sickness or by stress is that I

have not done a de-load period. So one of the things that I'm going to immediately implement is a periodic de-load according to the program

02:24:42 that you described. And I'm also going to start matching my specific goals for each quarter with time of year. I don't think I've done that. And it's not because I live in California. And by the way, folks, there are temperature variations and amount of light across the day variations in California as well, although they are not as dramatic as they would be near the North Pole, for instance. ANDY GALPIN: Yeah. They're pretty moderate. ANDREW HUBERMAN: Right. But of course, some of the listeners are at the equator.

02:25:06 So they have the opposite issue. In any event, I'm definitely going to do that. I'm going to start incorporating regular de-load periods. And I am going to be very dedicated, very disciplined about sticking to a program for three months devoted mainly to hypertrophy, then a three-month program devoted to fat loss, then a program devoted to aerobic output, and then one devoted to endurance. Although I must say, it's very tempting for me to do a very specific strength-dedicated portion. ANDY GALPIN: Sure.

02:25:40 ANDREW HUBERMAN: Because I don't tend to be particularly strong. I'm not weak, but I'm not particularly strong. So I might consult with you as to how I could vary endurance and strength. In any event, I love the idea of a macro-structure. And I love the idea of de-loads in anticipation of being able to go further in the long-run in terms of results. I'm hoping this next year, because we're just on the cusp of a new year, will be the first year in which I don't find myself getting some bug, or virus,

02:26:10 or whatever it happens to be from time to time and having to back off on training for that reason. And that prompts a question. And it's something that I want to get into in more detail with you when you describe recovery-- an upcoming episode. But a couple of quick questions. Maybe there are some short or short-ish answers you could provide. If I'm not feeling well, like I really had a poor night's sleep. Maybe just two to four hours of sleep for whatever reason. Train or don't train? That's the first question.

02:26:45 Second question is, if I'm starting to feel a little bit of a throat tickle, and I'm in that phase of denial, like I don't get sick, I'm not getting sick. And would I be better off bundling up some hot liquids, getting into bed, sleeping in a little bit more, et cetera, and protecting myself against that, or would I be better off training? And if I've-- and then the third question is-- if I've already succumbed to a bug, but it's not a severe bug. I don't have elevated body temperature. So no fever.

02:27:14 I'm not hacking up, not productive cough or anything like that. But I'm feeling just kind of not well, head cold-ish sort of thing comes to mind, and it's not seasonal allergies, train or don't train, leaving aside the point of whether or not I'm in a position to get anyone else sick. Because obviously that's a bad idea. ANDY GALPIN: Of course. ANDREW HUBERMAN: So lack of sleep, I would say, 30% to 40% of one's typical sleep the previous night, train or no train? Starting to feel like one might be getting ill.

02:27:46 And then the third category is coming back from being sick. ANDY GALPIN: Yeah. ANDREW HUBERMAN: Thanks. And sorry for the extended question, but I want to make sure there was enough detail there, because I think these are three common scenarios. ANDY GALPIN: We are going to cover that in the recovery conversation that's next in detail. And I will give you very specific guidelines. And we'll have plenty of time to go into that. The quick answer is, it comes back to what phase of training you're in.

02:28:12 Now, to walk through each scenario. If it is a crummy night of sleep, and I am in a phase of training in which we are trying to cause adaptation, I have a lot of space in my schedule, and I'm really using this time to make progress because I know coming up soon my schedule will change and my time to train will go down. I'm still training. I might use a bunch of tricks that we have for feeling better instantaneously. We call these little hacks. These are acute hacks. These are not chronic hacks.

02:28:47 I'm going to push the pace. If it is really close to a de-load week. Say it's Wednesday and I start my de-load next week. Or this is not one bad night of sleep, this has been four bad nights of sleep in the last five days. This has been six kind of crummy nights over the course of the last nine, and you're starting to see a larger pattern, then that's a different answer. So the question we're going to ask ourselves is, is this acute? Or is this a tendency, or actually a chronic thing? If it's acute, and we're close, we're

02:29:23 going to train through it. If it's acute and this is not a phase of training when we're trying to really push, then maybe we back off a little bit. If it's the opposite though, we need to probably make some changes and give ourselves some recovery. This may include anything from a moderate training session, maybe I'm going to go in the sauna and sit through that, and then do some breathing drills and some mobility stuff. Great. Maybe I'm going to go to the gym and ride the bike at 50% heart rate.

02:29:58 Something restorative like that. Gives you a little bit of energy but doesn't beat you down. That's probably where we're learning. If you're feeling sick and you think it's coming, I'm probably going to do option two as well, which is some sort of restorative training. So again, this tends to be moderate. Could be weights. Could be any of the stuff. Maybe you're going to go out for

your swim or whatever. But we're not going to push past probably about 70%. We can absolutely induce immunosuppression

02:30:24 with excessive training. And so, you may want to walk out of that. The last case, which was, I think, phase number three, you said there, which is, I got a pretty gnarly cold right now. Am I going to train? Most of the time for most people, I'm just going to say, just shut it down. Get out of there. If you're not going to be able to get productivity done there, you may be better off either going and sleeping, catching up on work doing other stuff. So that the next time you go to train you don't feel behind

02:30:52 and we can give a good solid effort for it. I know other people who will train right through it. I tend to not, to be totally frank. If I'm feeling kind of junky, I'm really not going to train. I may actually probably do some hot water immersion. So bath, Jacuzzi, things like that. I actually like those better than I like sauna. ANDREW HUBERMAN: If one is ill? Or you just like them better than the sauna generally? ANDY GALPIN: Oh, both, actually. ANDREW HUBERMAN: Oh my. ANDY GALPIN: Yeah. ANDREW HUBERMAN: First person I've ever met or come

02:31:20 on this podcast to say you like baths and Jacuzzi more than sauna. ANDY GALPIN: Yeah, absolutely. I may even do some ice. Probably not a ton though. Because you've got to be careful there. That's a big stressor. And if you're already over the line, you may be adding a pass there. Or I may go sleep. If I'm feeling very, very, very sleepy, and sometimes depending on what kind of a bug you get, that can happen. I will just sleep. And that might be the best choice you have. If that means you kick the cold half a day earlier,

02:31:51 then you just won in the aggregate. So those are probably-- it's a little bit of insight of the algorithm that I'm running with those things. ANDREW HUBERMAN: Those are highly informative answers. Thank you. And I look forward to our discussion about recovery so that we can go into even more depth on how to recover. ANDY GALPIN: The last thing I do want to say here is going back to our quarter system. The examples I gave with the bulking up, losing fat, and then getting into better fitness and cardiovascular fitness at the end,

02:32:25 those were just samples. Friends, please don't take that literally. If you want to emphasize strength more, put in some more strength. If you want to emphasize a different one of our nine adaptations, great. Do that too. If you're somebody who has a lot of body fat to lose, then maybe put that for two consecutive sessions, or every other. You can modify them. We've talked about nine very specific training adaptations as well as in fat loss. I only gave you four, which is just meant to be a sample that you can roll in or out.

02:32:59 But use those priorities to adjust that system according to what is important for you now, five years, and then 45 years down the line for whatever that may be. So you are absolutely free to modify the order. You're absolutely free to modify the primary outcome. And then, adjust the specifics within each quarter based upon what is needed to do to optimize that outcome. I think maybe one more tool we can offer people is maybe giving the individual week a little bit more structure. So the system I laid out is month by month.

02:33:36 And maybe we can lay out, say, a three-day a week workout program and a four-day a week program. That would still hit some of the same well-rounded adaptations. That probably covers maybe not individualized per bucket that we've talked about. A, B, and C, but it's going to cover 75%, 80% of what we'll need to occur in all three buckets. And then, you can use that last 25% for your individual goal or specialization. So maybe we can jump into that next. ANDREW HUBERMAN: Great. Let's hear it. ANDY GALPIN: The first one I want

02:34:07 to give you is just a basic three-day split. That, again, same idea. It's a well-rounded exercise program. I actually wrote this all in an article that is on XPT's website. So perhaps we can link directly to that. I will just jump you straight to the answer. You can read more about why and details in that article if you'd like. But this is day one, day two, day three. You could do these days where you split them up, actually having, say, 24 hours in between, or you could do these back to back. It doesn't necessarily matter.

02:34:38 In this particular case, say, day one you would start off and do a little bit of speed and power. And then you may finish that with a little bit of hypertrophy. Now, if you want to gain more speed and power you just do more of it. If you want to maybe just do a little bit to touch it, and you really want to gain some muscle, you would do more of an emphasis there. So the template can stay the same, and you would just increase the amount of either adaptation, the speed and power stuff, or the hypertrophy,

02:35:04 based on how high it is in your priority list. Those are combined together because, as we talked about earlier, they don't necessarily interfere with each other. You would do the speed and power stuff first because it wouldn't hamper the hypertrophy. If you did the hypertrophy first in that workout, it would probably compromise your speed and power. And in that case, you would actually not be getting your adaptation. So day one you do that. And that could be a 20-minute workout total, or a two and 1/2

02:35:30 hour, up to you. Then you would come back maybe the next day or two days later, whatever you'd like to do. In your second day of exercise, you would start off with a pure strength protocol. And you would finish that with what I'm calling just a higher heart rate. So this could be something like our anaerobic capacity stuff. It could be the aerobic capacity, something where

you're getting up to close to high heart rate. It could be those 20-second bursts. It could be a 90-second burst, five-minute mile repeats,

02:35:58 anything you like. You can just plug and play this in. You're getting to a spot now where you've had a little bit of speed, a little bit of strength, a little bit of hypertrophy, and you've touched the high heart rate. So we've checked off most of the boxes already in two sessions. Our last session then would be more of a steady state long duration endurance. And so, a three-day week split like that is going to be a pretty nice setup for the average person. ANDREW HUBERMAN: So this could be a Monday,

02:36:24 Wednesday, Friday, Tuesday, Thursday, Saturday. What's happening on the intervening days? ANDY GALPIN: Totally off if you want it to be. So I set this up as the best I can give you, Andy, is three days. Great. If you have more, we could certainly improve it. But this was my worst case scenario. I've got other things in my life. The most I could do for exercise is three days a week. ANDREW HUBERMAN: And given that it's three days per week, how long-- approximately how long each of these workouts going to last?

02:36:50 ANDY GALPIN: I would do a whole body exercises for almost all that. I would do your full body parts. And I think you could certainly finish that in 45 minutes of work time. A little bit of time to warm up, some down-regulation at the end. You could be in and out of that gym in certainly under 60 minutes. The reality of it is you could probably be out of there in under 50 minutes. The total work time could be 30, 35 once you get going. ANDREW HUBERMAN: So that's three days. As you pointed out, probably more work per week

02:37:18 is going to be better in terms of maximizing goals of aesthetic goals, and performance-enhancing goals, and longevity goals. ANDY GALPIN: Yeah. ANDREW HUBERMAN: I mean, the numbers that I've heard is that we should all try to get somewhere between 150 and probably more like 180 to 200 minutes of zone two cardio per week minimum. But as I recall, you consider zone two cardio so low intensity that just walking around qualifies as really zone one, zone two cardio. ANDY GALPIN: Yeah. Not to take us too far off track.

02:37:52 But I think it's actually useful to differentiate what I consider to be exercise and physical activity. So physical activity is out for a walk. It is using a walking treadmill while you're at work. It is parking farther in the parking lot and taking more steps. These are all important. And what's clear, you are not going to reach, likely, optimal health by only exercising hard and then sitting around the other 23 and 1/2 hours of the day. So it's very, very important. Whether you want to do that in the form of zone one or zone

02:38:30 two and hit 30 minutes a day. Various organizations will say things like that. You need to have 30 minutes a day of moderate to low-intensity exercise. I don't really care. You can combine it like that if you want. What you don't want to do is just physical activity only, which is almost always going to be like zone one to maybe zone two. You also don't want to go the other end of the spectrum, which is, again, I lift hard three days a week. And then what to do you do the rest of the time? Nothing.

02:39:00 That's not optimal either. And so, I guess the system I walked you through here-- or the example, rather, I walked you through is-- you would need to maybe supplant that with being physically active. If you work, say you're a nurse, and you're on your feet. You're moving up and down. You're probably actually covering a decent amount of your physical activity because you might be at 15,000 steps a day. If you're sitting in front of your computer and you do this same three-day split, you would probably need to go out

02:39:28 of your way to make sure you're adding a bunch more steps. And so, you might need to add several hours of walking to hit that 150, 180 minutes a week of physical activity. Because the program I laid out is, if you're doing, really, 45 minutes three-days a week, maybe 60 minutes, at best you've hit 180. 60 minutes times three, 180 a week. So you might actually need to then throw in maybe some more specific walks. So you could do that in a number of ways. It could be, again, actual structured exercise.

02:39:57 It could be simply I'm going to do a 10-minute walk three times a day. It could be the exercise snacks that we talked about in a previous episode. So there's lots of ways to engage in more physical activity. But to me, those are different, oftentimes, than structured exercise.
ANDREW HUBERMAN: I think many people will appreciate that you put out there for us a three-day-a-week protocol, because many people simply don't have more time to exercise. They're putting emphasis on these other bins in the quadrant.

02:40:26 And frankly, those other bins are very important as well. So wonderful that people can check off some critical boxes for aesthetics, and performance, and longevity with three days of work or workouts, per week, I should say. What are some other schedules that people can follow if they're willing to dedicate a bit more time toward their fitness? ANDY GALPIN: Sure. If you wanted to do another sample of maybe a four-day week. And again, to clarify this, I'm really happy you said that. This is a four-day a week of structured exercise.

02:40:58 This would not account your physical activity and moving around. ANDREW HUBERMAN: Which everybody should be doing. ANDY GALPIN: Absolutely. Maybe this is something like day one you're going to do a strength-training session, and you'll stay in the five to 10 or so repetition range. A little bit of strength, a little bit of hypertrophy, you've checked off a couple of

boxes. Probably whole body, so that you get all the body parts covered or close. We're looking at generally multi-joint exercises.

02:41:27 Could be combination of barbells, free-weights, bands, machines, anything like that would be day one. You could come back the very next day, or you could wait 24 hours. But the second day of your exercise would be maybe your long duration. And this is actually sort of similar to how you set it up. It's you do a little bit of the inverse. But what you're kind of saying is, I'm probably going to be a little bit sore from day one. And I don't have any free body parts that aren't sore. So instead of trying to do another lift or something,

02:41:57 I'm just going to put in some restorative longer duration stuff-- same exact principles for long duration we just talked about. It could be a swim. It could be any number of things. Could be your sport. It could be you're out, ride the bike and go for a jog in the sun, whatever you would like to do. If you're feeling better, maybe that's a little harder longer. If you're feeling pretty beat up from the day before, maybe that's a little bit shorter and slower. You can modify it. Then maybe you take the next day off.

02:42:27 Or that's open. Your third day of exercise is now, instead of being that five to 10 repetition range for your lift, you do something like 11 to 30 reps range. Also, this could be exchanged for something more like body weight, more muscular endurance type of stuff. So this is a great day, maybe it's yoga. Maybe it is a gymnastics thing you're working on, or any of the many other styles of training that are not quote unquote lifting weights. But they're not just walking and hiking. So it could be a Pilates, or equivalent, anything

02:43:01 like this where you're going to get some muscular burn in there. But it's probably not any additional weight outside of body weight, or if it is, it's fairly minimal, five, 10, 15 pounds, something like that would be nice. Could also be done in a circuit. So we could hit our high heart rate and we could hit some muscular endurance in there. Group activity class might be nice here. Even maybe something like a spin class or a dance class. All these things could be great. And then, maybe you even finish that with 10 minutes

02:43:33 of some light weights to hit the body part you say didn't get. So maybe you did the dance class. And then you finish and you do 10 minutes of upper body sets of 30 to make sure you get a nice pump there, because your legs probably got some work during the dance class, but your upper body didn't. And so you balance the system out a little bit. So all body parts got a little bit of muscular endurance. Your heart rate got really high, came back down, and you checked both of those boxes. Now, it's important to remember the hypertrophy episode.

02:44:06 Doing sets of, say, 15-plus repetitions per set is as effective as doing sets of five to 10 or 12 for hypertrophy-- gaining muscle. It's not effective though for strength gains. So you wouldn't want to do this only, because you'd really be doing nothing to improve your muscle strength. And you want to make sure that that box is ticked at least a little bit. Then, again, you could take the day off after this. Or you could roll right into your fourth exercise day, which would be your last exercise session of the week.

02:44:38 And you would do something more of a medium intensity. So this is a little bit higher intensity than our second day. And this could be something like shadowboxing, or hitting a heavy bag. It could be a little bit of higher intensity intervals, but not all the way up. So maybe this is you're going to do a one minute on, one minute off on the bike. But you're only going to go to 85%, 90% heart rate. And then, instead of going off during that one minute, you drop it down to 50%. So we would actually look like 30 minutes of straight work,

02:45:14 but you would have a little bit of rolling intensity as opposed to staying really nice and restorative. It's going to be some work there. And you would finish it with something like five to six minutes total of max heart rate stuff. Which lines up perfectly with that number you actually [LAUGHS] created on our endurance episode of hitting six minutes total per week of maximum heart rate or close. So you could wrap that all up into one session. You could do those in the inverse order, thorough warm-up, a few minutes, whether you

02:45:48 want to do 30-second bursts or a minute burst, or straight five minutes. This is a protocol I like to use a ton on the assault bike. It is simply a good warm-up, 10 minutes solid warm-up. Recover, and then I'm going to go five minutes and cover as much distance as I can in five minutes. ANDREW HUBERMAN: Brutal. ANDY GALPIN: It is brutal. And it's amazing. And you get a lot done in five minutes. 10 minutes on the back of that is a very gradual bring back to Earth there. I actually, in that case, I don't

02:46:17 need to do down-regulation breathing, because I've spent 10 minutes actually coming way back down. And the last two minutes or so of that is very deliberate, five-second inhale through the nose, five-second exhale through the nose while I'm barely just moving. And you end up being in a pretty good spot. So that, again, time-wise could easily be done in 30 minutes. And you'd be rounded off there. So the nice part about this four day a week split as well as a three day a week split is it does give you a little bit of flexibility.

02:46:47 And so, what I mean is, maybe Monday your plan is to do the day one lift. And then, any number of things popped up in life. Just shift it back to Tuesday. Rather than saying Monday is leg day and then all of a sudden, something happened, you miss leg day. It's just you're doing these things in order. And you would like to get all four done in a seven-day span. But if it doesn't happen,

fine. The next day you get to work out, you just go right back into the next workout. And it doesn't matter what day they land on exactly.

02:47:17 For the three-day routine, that works very nice, because the assumption there is you really only have time for three workouts a week. And so, that's sort of implicit is there's probably some chaos happening in the schedule a little bit. And you don't really have the ability to lock in three days per week. If that's not the case, you can go. But we're trying to listen to the pain points that people have with exercise and see if we can give them some solutions for those. ANDREW HUBERMAN: Several things about this program

02:47:49 are attractive to me. One of them you just mentioned, which is that by not rigidly attaching individual workouts to specific days of the week, one, in theory, could say, OK, it was-- I didn't get that much sleep last night. I don't feel-- I know that a lot of people say, what is feel? But I don't feel recovered, or like I'm going to get that much out of the workout tomorrow. So I'm-- or today-- so I'm just going to push it forward a day. And the ability to slide workouts forward or back by day I think is incredibly valuable for the consistency's

02:48:22 sake. I also really like this idea of some of the long duration work coming a day after hitting the strength and a bit of hypertrophy work. So this would be the day two. One thing that I've experienced over and over is that if I'm very sore in a given muscle group, especially my legs, doing some low intensity cardio, whether or not it's a jog, or on the bike, typically for me it's a jog, or even skipping rope and walking does seem to dissipate the soreness. I'm sure there's a mechanism-- there has to-- there's a mechanism for everything, frankly.

02:48:55 ANDY GALPIN: Yeah. ANDREW HUBERMAN: But I like that arrangement. And then, I also like this idea of making sure that there's a workout for muscular endurance. Because I feel like unless I've been stuck without a good gym, or I've decided to specifically train bodyweight exercise, which I did a few years ago, I got really excited about some of Pavel Tsatsouline's work. ANDY GALPIN: Sure. Great stuff. Yeah. Amazing. ANDREW HUBERMAN: He has a book, The Naked Warrior, which doesn't involve training naked, although I suppose

02:49:25 you could if you wanted. But it was really about no weights. And involved building up to pistol squats and one-arm push-ups, and things of that sort, even doing pull-ups on doors. And I discovered that some door frames are much stronger than others in hotels. [LAUGHTER] I just accidentally caused some damage there. But in any case, muscular endurance, I think, is a really interesting one that I plan to incorporate into my schedule. But that is, I think, is one that's often overlooked, unless people really have an aversion

02:49:54 to weights and to machines. ANDY GALPIN: You're right. And it shouldn't be. Because it's pretty low-hanging fruit. You don't need a lot of equipment for it typically. It doesn't hurt that bad. You don't often get that sore out of it. And you're going to feel a nice wonderful pump afterwards. So it's great. And as we discussed many times now, it is quite effective at hypertrophy. ANDREW HUBERMAN: Yeah. I also-- I don't know if they fit specifically with muscular endurance. But if you look at the physiques, for example,

02:50:21 on rock climbers, I mean, they have-- to me, of course they have-- usually the experienced climbers have pretty remarkable body compositions. They tend to be lean, and lithe, and flexible, all those things that many people aspire to. But the other thing is, their development always looks exceedingly balanced. You don't really tend to see climbers that are overdeveloped in the torso and underdeveloped in the arms, or overdeveloped in the arms despite all the climbing and underdeveloped relatively

02:50:50 in the other limb movement. And that's true for women and men. It's not a sport that I participate in. But it seems like what they're doing is essentially muscular endurance training. ANDY GALPIN: Basically. Yeah. ANDREW HUBERMAN: Yeah. So there's really something there to be valued. So that's a four-day a week schedule with off days or rest days inserted as needed. And then just-- and continuing. For those that are a bit more committed to their fitness and want to do a five or six-day a week program,

02:51:21 would you recommend just collapsing some of the off days, paying more attention to recovery, and cycling through more quickly? ANDY GALPIN: Yeah, absolutely. You could combine that and just run that-- either one of those programs. So you could run that three-day week program back to back. Do it, get that done in six days. ANDREW HUBERMAN: Ah. So day one, speed, power, hypertrophy. Day two, strength, work with elevated heart rate, anaerobic capacity. And day three endurance. And then just-- and then just cycle through again.

02:51:47 ANDY GALPIN: Yeah. You take day four off of the week. And then you go back again. So we would be having six days of exercise, one day off. And you'd be getting every one of those adaptations in multiple times a week. That is almost exactly how I would set up a six-day-a-week program. ANDREW HUBERMAN: Great I love the elegance and the simplicity of that and the thoroughness of it, because it checks off so many, if not all of the nine major adaptations to exercise that we've been talking about these episodes.

02:52:13 And I suppose the one thing that I want to highlight and pose this also as a question is that early in our discussions, in a previous episode, you mentioned that so much of what people think of and apply as it relates to resistance training is borrowed from bodybuilding and hypertrophy training specifically. Which typically involves getting close to failure or failures, sometimes even

involving rest pause, where you hit failure, then set the weight down for a few seconds and repeat these high intensity techniques,

02:52:43 accentuating the negative, so-called the centric, et cetera. In hearing about these protocols of three-day-a-week, or four-day-a-week, six-day-a-week, it's very clear to me that if one is not careful to omit that kind of thinking, and suddenly is taking their strength work and speed to failure, or is pushing too hard on muscular endurance to the point where you're just grinding out that very last push-up on every set, that the amount of soreness and the amount of recovery that results from these workouts

02:53:15 might start to cause progress issues. So one thing that's in the back of my mind is, as you've described these programs is, that even though some of them are very brief or involve a minimum of time commitment, in particular a three-day week but also the four-day week schedule, that there is a discipline involved in making sure that you stick to the workout that you're supposed to do that day. And not go ham, as they say, and just throw in a couple of extra sets of bicep curls and tricep pushes, because you want to do that and you

02:53:44 thought you could maybe you could get away with that. But you have to come back pretty quickly and do some serious, meaning devoted, speed and power work and/or strength work. And if you haven't been disciplined about not doing certain forms of exercise, I could see how the whole thing could crash quickly, and one could think, oh, this is just too much work, or it's not for me. ANDY GALPIN: Yeah. ANDREW HUBERMAN: So this, I suppose, is now where the question comes, which is, what are some of the key points

02:54:12 that people need to keep in mind when they embrace a program? How rigidly do they need to stay attached to today's endurance day. I'm just doing endurance. Today's strength day. I'm just doing strength work. I'm not going to take things to absolute failure or beyond failure. ANDY GALPIN: I am absolutely happy with anyone modifying any of the sample programs however they would like to. My only recommendation for the question you just posed would be set your program. And then, if you're going to make a change, fine.

02:54:48 But that is a change to your program. In other words, don't just make decisions every single day and make changes. If you're doing that, you might as well not have a program. And as we described earlier, there is clear evidence that having a program is better than not, regardless of the effectiveness of the program. And so, my general comment to that is, OK, fine, a day or two, you made some modifications. No problem. We're in a situation now where you're basically changing the workout every day as you go,

02:55:18 then we just need to write a new program. We need to reassess where we're at. Because we need to have some structure. Look, the reality of it is, I change the programming I'm going to do the day of often because of any number of situations. I just don't feel like it. I way overestimated today. We talked a little bit in the previous episode about autoregulation, which is a style of periodization and program design in which you're adjusting based on how you're actually feeling that day, but with some specific structures.

02:55:46 So you're going to take some measurements that day and adjust. So autoregulation is a very, very effective tool. You just need to make sure that auto is dialed. In other words, is it because your body actually needed something different? Or is it because you're now just getting a little bit lazy? Now you're just not feeling like it today. So there's a little bit of an impossible line to draw there. Both scenarios are real-- gray area-- a lot is real in the moment. And so, you just need to be a little bit

02:56:13 aware of having some reality check, listening to your body, but then also being like, hey, no, I'm talking to you. I'm telling you this is the plan. We're going to do this. And staying within it. It is going to be challenging to progressively overload and therefore get a higher likelihood of success at your training program if you're just making decisions and changing the program right before you work out. You're probably not-- you're probably going-- for most people, you're probably going to choose less or off more so than you choose more.

02:56:48 Now, having said that, there are more than a few clients that have come through our programs where they choose more always. They add a set. They add an exercise. They add in another workout. And that can be OK. But we're going to track various markers on them. And if we see these things consistently going down, we're going to identify whether they are-- which phase of this overtraining thing we'll talk about next they're actually in. Some phases I'm OK. Some of them I'm not. If we're seeing certain things happen physiologically,

02:57:20 we're going to make a conversation. We're also then going to really think carefully about why are you making this choice? Do you feel like the training isn't enough? OK, great. Let's modify it then. Are you not making progress? Or are there some other reasons why you're doing this? Obviously, I'm not a psychologist or therapist. But there are clearly situations in which folks dose themselves with far too much exercise for reasons that are not because it's productive to their training or goals. And if such a case, we would probably

02:57:53 bring in somebody that specializes in those areas to clear that out and just make sure it's like, we're not doing this for anxiety issues or energy things. If it's, I just don't think the program's enough, OK, great. Let's go back. Let's look at our metrics. Let's evaluate our tests and go there. But if there's other reasons, then we may bring in somebody to have that conversation.

ANDREW HUBERMAN: Yeah. Usually when I've seen people deviate from programs, it's because they tend to revert to something that they've

02:58:18 done for a long time. It just feels really comfortable to them. ANDY GALPIN: Yeah. ANDREW HUBERMAN: And it worked. ANDY GALPIN: Yeah. ANDREW HUBERMAN: And it was giving them decent results. So they're skeptical to try something else. Or there is a phenotype of haphazardness sometimes, especially if people get really caffeinated before a workout and just want to throw something in. And then, there's a third category. And this is one that I've had to contend with a lot in my life, which is that I really enjoy training

02:58:39 with other people when I have the opportunity. ANDY GALPIN: Yeah. ANDREW HUBERMAN: And a certain day rolls around where you're supposed to do something and not do other things and people say, hey, do you want to go for a long ocean swim? Or you want to train? And you end up doing some Kenny Kane, this one's for you, some ridiculous 20 wall ball CrossFit type workout. And I'm not acclimated for that sort of thing. ANDY GALPIN: Yeah. ANDREW HUBERMAN: And then it does tend to throw things off, not because--

02:59:03 no pun intended, Kenny-- because there's nothing wrong with a 20 sets of wall balls if you're-- that's part of your conditioning. ANDY GALPIN: Yeah. ANDREW HUBERMAN: But if it's not appropriate for where you are in your schedule, it really can disrupt what you're trying to do. ANDY GALPIN: Yeah. ANDREW HUBERMAN: Even as a non-competitive athlete, like myself, years since I've competed in any athletic program. But as a non-competitive athlete, I think there's a beauty to and a really strong incentive

02:59:30 to being disciplined about the program that one follows. As a mentor and professor that I worked with years ago used to say, I'd come into his office, all these ideas and things I want to do. And he'd say, let's constrain this walk. And then the question you always want to arrive at in a discussion with your students, as you know is, what's the experiment exactly? And then you go and you do that specific experiment. I think I view a workout the same way, that there are multiple adaptations, goals,

02:59:58 and things that people are trying to achieve. Really knowing why you're there each time and really sticking to that, even if it means not training with other people. Or I always say, well, you can train with me, but I'm not going to train with you. [LAUGHTER] ANDY GALPIN: Selfish. ANDREW HUBERMAN: So that's one way to do it. But really sticking to a schedule is really what allows the progress to emerge. But that doesn't necessarily mean being antisocial. You can invite people along. ANDY GALPIN: Yeah.

03:00:21 ANDREW HUBERMAN: But in this case, I'm telling people to be the host, not the guest. ANDY GALPIN: I have a little bit of a rule here. Maybe I should have answered your question this way. I actually like doing things totally different occasionally. So I'll do-- when I'm traveling, I tend to do hotel workouts. What I mean by that is, I will go down to the workout room. And I will do a set of 10 to 15 reps of every single machine in the exact order in which they are laid out. ANDREW HUBERMAN: Whoa.

03:00:46 ANDY GALPIN: Just for the sake of fun. Just for the sake of, OK. ANDREW HUBERMAN: It's like the tarot card version of workouts. ANDY GALPIN: Yeah, totally. ANDREW HUBERMAN: It's like, whatever comes up, I'm going to make sense of it. ANDY GALPIN: And you just move. ANDREW HUBERMAN: Yeah. ANDY GALPIN: And those are typically things of like, I just want to move a little bit for jet lag and other purposes. That's often, I wasn't going to get to work out today. And so, now I'm going to do something to feel great.

03:01:07 I don't travel that much, though, so it's not really throwing my things off. I also, I don't get a lot of free time. And so, if I am traveling, and I'm seeing someone I haven't seen in many years or, for the first time, I mean, we got to train together this week for the first time. ANDREW HUBERMAN: It was a lot of fun. ANDY GALPIN: I'm not going to burn that opportunity. My rule is this though. I'm not going to do something that's going to cost me more than three days. So I'm absolutely happy to get out there,

03:01:35 and maybe tomorrow morning, or tonight, we go do something fun that's off my schedule. I'm in. I'm in 100%. I'm just going to down-regulate a little bit. I'm not going to maybe do as much as you or as hard as you or whatever. I'll do more than I should. But if it costs me tomorrow, it was worth the exchange. I don't have a world record I'm setting anytime soon. I don't have-- I got many years. I'm happy to give up a couple of days of exercise to be a little sorer than I need to be for the exchange of a lifetime memory.

03:02:05 And this stuff is so important to me. This stuff lands as true lifetime memories. I can look back-- many of my fond memories from my life are training sessions with friends, whatever it is, like doing jujitsu with somebody who's a world champion. You're just like, whatever the thing is, you're like, that was really, really cool. Absolutely worth missing two days. If it's going to be more than three days though, where I'm going to be so wrecked I can't work out for five or six days, then I'm probably like, all right, that's kind of nonsense.

03:02:32 Unless it's just an opportunity where I'm like, I absolutely can't pass that up. So that's how I think about it. That doesn't happen too often with me though, maybe once a month. And so I'm like, OK, fine, I lost a day. Reality of it is it's probably more like once a quarter that that happens. So I don't really care. So you do want to balance joy and life. You don't want to be so rigid

about your training program that it ruins and robs those experiences. Physical activity should be fun. Your fitness and your training should

03:03:03 be something that makes your life better, not some task you have to get done so that 75 years from now you've hit some metric of who knows what. ANDREW HUBERMAN: Just alone in your room with your training logs. ANDY GALPIN: Yeah. [LAUGHTER] ANDREW HUBERMAN: No, in all seriousness, I think, you point to the richness of life. And you can draw these boxes like work, relationships, fitness, recovery. But the boundaries between those boxes are blurry, because-- ANDY GALPIN: Of course. ANDREW HUBERMAN: And I should say,

03:03:30 I love training with people. I greatly enjoyed training with you this morning, not just because I was receiving so many useful tips. In fact, thank you. First time I PR'd in a number of things today. ANDY GALPIN: Yeah. ANDREW HUBERMAN: Thanks to your input in the moment. And that's an irreplaceable kind of gift. But mostly, it's the gift of getting to train with a colleague and friend. So I want to underscore, highlight, and put an exclamation mark behind what you just said. Thank you once again, and again, for giving us

03:03:57 so much interesting, clear, actionable, and at times somewhat counterintuitive information in order to build out an exceptional training program to meet any of-- and in some cases-- all of the nine major adaptations that exercise can create toward aesthetic, performance-related, and healthspan lifespan, aka longevity goals. It's really a treasure trove of information there. And I look forward to our next discussion about how to best recover from exercise, both within the exercise bout, and between exercise bouts,

03:04:36 and in the more macroscopic structure of a week, a month, a year. I can't wait. ANDY GALPIN: I can't wait either. I love that topic. And I've got a lot to cover, so it'll be fun. ANDREW HUBERMAN: If you're learning from and/or enjoying this podcast, please subscribe to our YouTube channel. That's a terrific zero-cost way to support us. In addition, please subscribe to the podcast on Spotify and Apple. And on both Spotify and Apple, you can leave us up to a five-star review. If you have questions for us, or comments, or suggestions

03:05:04 about topics you'd like us to cover, or guests you'd like me to include on the Huberman Lab podcast, please put those in the comments section on YouTube. We do read all the comments. Please also check out the sponsors mentioned at the beginning and during today's episode. That's the best way to support this podcast. I'd also like to inform you about the Huberman Lab podcast free newsletter. It's called the Neural Network Newsletter. And each month, the Neural Network Newsletter is sent out, and it contains summaries of podcast episodes,

03:05:30 specific protocols discussed on the Huberman Lab podcast, all in fairly concise format, and all completely zero cost. You can sign up for the Neural Network Newsletter by going to hubermanlab.com Go to the menu and click on newsletter. You provide us your email. We do not share it with anybody. And as I mentioned before, it's completely zero cost. By going to hubermanlab.com, you can also go into the Menu tab and go to a newsletter and see some example newsletters from months past. Thank you once again for joining me for today's discussion

03:05:57 about fitness, exercise, and performance with Dr. Andy Galpin. And as always, thank you for your interest in science. [MUSIC PLAYING]

00:00:00 [Music] welcome to the hubman lab guest Series where I and an expert guest discuss science and science-based tools for everyday life I'm Andrew huberman and I'm our professor of neurobiology and Ophthalmology at Stanford school of medicine today marks the second episode in the sixth episode series with Dr Andy Galpin a professor of kinesiology at Cal State University Fullerton and one of the foremost world's experts on the science and applications of methods to increase strength hypertrophy and endurance today's episode is all about

00:00:31 how to increase strength speed and hypertrophy of muscles Professor Dr Andy Galpin great to be back last episode you told us about the nine specific adaptations that exercise can induce everything from strength and hypertrophy to endurance muscular endurance so on and so forth and you gave us this incredible toolkit of fit tests for each of those adaptations so that people can assess them for themselves and then of course improve on each and every one of them if they choose by the way people can access that information simply by

00:01:04 going to the first episode in this series with you and it's all there in time stamped and I highly recommend people do that today we're talking about strength and hypertrophy and so right out the gate I just want to ask you why should people think about and train for strength and hypertrophy and that question is of course directed towards those that are trying to get stronger and grow bigger muscles but I know that many people out there perhaps have not thought about the benefits of strength and hypertrophy training and how

00:01:33 beneficial it can be not just for people that want to get bigger biceps Etc but that have other goals longevity goals and health goals unrelated to what most people associate with hypertrophy so what are the benefits of training for strength and hypertrophy for the everyday person for the athlete for the recreational exerciser and so on there's a wonderful saying um I think it was Bill bman the founder one of the founders of Nike and he always said if you have a body you're an athlete and and I think that's very important for

00:02:04 people to understand because one of the major disservices we've done in this field is convince people that things like strength training are for athletes or for growing bigger muscles and cardiovascular training are for things like fat loss and heart health and that is a tremendous disservice because it puts a lot of unnecessary barriers and leads to a lot of false assumptions and therefore poor actions uh classic examples of this are people who are resistant to strength training because they don't want to put on too much

00:02:36 muscle um people who only perform one type of exercise because they want say fat loss or they're in it for longevity and health and they don't worry they're not worried about you know being an athlete and so right out the gates we can actually draw back a little bit to what we were our previous conversation when I walked you through the history of of exercise science and the reason I did that is to help you understand these are the railroads that you're running down and you don't even realize it in terms

00:03:02 of everyone thinks of strength training and they immediately default to our principles to optimize muscle growth and that's not the only adaptation one should be after with strength training when we think of endurance training we immediately default to things like again cardiovascular health or fat loss or things like that what I really want to do across this entire um series and conversations is to to just break that immediately talk about all the other things that you can do with your with your training uh and so that people can

00:03:32 be comfortable and confident in doing an optimal training program for whatever goal they have whether that be specific like growing muscle or non-specific like just feeling better having more energy um being more prepared for life and and Longevity and so to directly answer your question I could really we could do a 100 episodes on the benefits of exercise and we could run all the way from mood and focus um cognitive tasks to a better immune function you'll get less colds you'll be you'll fight them off more

00:04:03 effectively um to mortality right so some of the strongest predictors of how long and how well you will live or exercise however there are independent benefits that come from just endurance training and there are independent benefits that come from strength training and so to just give you one categorically the way that you want to think about this is resistance exercise and strength training is the number one tool to combat neuromuscular aging you cannot get that through any other form of exercise besides heavy overload

00:04:34 strength training and we and we can walk through in detail what that is but that is reason number one in general human movement is is a function of number one some sort of neuromuscular Activation so nerves have to turn on the second part is muscles have to contract and the third part is those muscles have to move a bone all right if you want to be alive and you want

to live by yourself you have to be able to engage in human movement if you have any dysfunction in the neuromuscular system there then

00:05:03 you're not going to be able to do that and again as I mentioned the only way to preserve that or fight that loss of Aging is to strength train so people will tend to hear numbers like you lose about 1% of muscle size per year after age about 40 and that's true however what they don't realize is you lose about 2 to 4% of your strength per year so the loss of strength is almost double that the loss of muscle mass with aging muscle power is more like 8 to 10% per year and so we can very clearly see the

00:05:36 problem you're going to have with aging is not going to be preservation of muscle although that is incredibly important it's going to be very specifically preservation of muscle power and strength and why that really matters is your ability to again stand up and move your ability to catch yourself from a fall your ability to feel confident doing a movement um that is the function of muscle power more than it is muscle size and so functionality is really what we want to be right you want to be able to do

00:06:03 whatever you want to be do physically and feel confident in doing that as you age that's going to only be obtained through strength training so is it appropriate to say that training for strength and hypertrophy is also a way to keep your nervous system healthy and young yeah absolutely it is the only exercise route we have for that uh if you look at just basic numbers like motor units you're going to see that older individuals have like a 30 to 40% production in total motor units So when you say

00:06:33 older approximately what ages are you referring to because I know many people out there such as myself are 40 and older but I know many of our listeners are in their 20s maybe even in their teens and I can imagine that people that start doing strength and hypertrophy training younger will afford themselves an advantage over time but that everybody should be doing strength and hypertrophy training for as much of their lifespan as possible that's really the message that I'm getting um so if somebody is for instance 45 would that

00:07:04 fall into the bin of older you're going to start seeing decrements past again around that age of 40 or so now there's a lot of genetic variation there and a lot of other things go into that equation like your sleep and your nutrition but that's a fair number to sort of think about um one actually response is it's actually sort of counterintuitive the wonderful thing about strength training is you don't actually have to start at a young age uh you can actually in fact I was reading a paper this morning because of our

00:07:30 previous conversation it was in over age 90 so these are folks 90 plus and they saw improvements like 30 to 170% in things like muscle size and hypertrophy over a very short period of time I think it was 12 weeks so you don't actually have to start there are some adaptations that you're going to need for health that you God you really need to start in your 20s the reason I like to mention that is because if you are listening and you are 50 and you're like oh I I haven't been strength training you're not toast

00:08:00 like you should absolutely start now but you you're going to be able to get to a a fantastic spot very quickly similarly though if you are 20 or 25 and 30 and you aren't lifting there are still many reasons why you should do that now and I I'd like to point that out because a lot of folks will be like oh my gosh they said I have to do it when I'm 20 or 25 or you know I'll be sort of screwed and that's not the case at all there's really no age limit on this in fact there's actually interesting data that

00:08:28 just came out showing um this reduction in muscle strength and hypertrophy that I sort of talked about is basically amiliar with a preservation of activity in other words you don't lose these functionalities because of Aging you lose these because of a loss of training to state that again you don't lose these because of some innate physiological thing that happens with genes become less sensitive or you lose functionality you pretty much can describe the loss of function of strength and muscle in aging as

00:08:58 exclusively because of a loss of training in nutrition and and anabolic resistance and some other things so you can do a lot more than you think um when it comes to maintaining high quality muscle and that's really important to point out I'm reminded of the words of the great shington he won the Nobel Prize a physiologist uh I guess the neuroscientist try and claim him as a neuroscientist because he worked on the nervous system the physiologist claim as a as a physiologist he is 100% a physiologist I would call him a

00:09:26 neuroscientist maybe we can argue about this later um we will but I think one of the key things that shington pointed out was that and I believe the quote was that movement is the final common path and what he was referring to was the fact that a significant fraction of the brain itself is devoted to our ability to move and our ability to engage in resistance type movements and that resistance type movements and the continuation of movement throughout the lifespan is what keeps the brain Young

00:09:59 and healthy and vital and there are so much data now to support that but I'm so grateful that you brought up early this fact that there's a neuromuscular link because I think a lot of people think about muscoskeletal they forget that the nervous system is really in charge of the um strength of of the muscle contractions and the types of muscle contractions that occur I'm certain

we're going to get into that in a lot of depth today you're close there we're not totally right but we're close Okay well

00:10:26 I look forward to being corrected um and to achieving the Precision that you're known for uh around that discussion so if we are to step back and say strength training and hypertrophy training is critical for people of all ages yeah for developing and maintaining the neuromuscular system and for our ability to function in the world yeah not just offset injury but the ability to pick things up and move Etc what are some of the other things that strength and hypertrophy training um can provide I know a lot of people use

00:11:00 strength and hypertrophy training for changing their Aesthetics yeah what is your sense about its potency for changing Aesthetics as compared to say cardiovascular exercise yeah the the Mantra I always like is the reason you want to exercise is three-fold right you want to look good feel good played that that's really that comes from sport um comes from football specifically we always say that and what that means really is you want to look good people want to look the way they want to look whatever that means to them and there

00:11:27 are any versions of what you feel to be a i al pleasing and that's totally irrelevant but people want to look the way they want to look um number two you want to be able to feel good what's that mean you want to be injury-free you want to have energy throughout the day you want to be able to execute anything you want to so whether you want to go surf in the morning you want to play ret ball or you want to hike or you want to do all three of those in one day you should have the ability to do that and then you

00:11:49 want to play good which means you should be able to execute um any again activities uh that you want to execute whatever that means all right so backing all up what's that got to do with your question um um one of the major benefits of strength training is the responses tend to happen extremely fast so you can see noticeable changes in muscle size certainly within a month absolutely within six weeks and so we have this wonderful feedback loop that sort of tells you am I doing this incorrectly oh

00:12:17 my gosh yes I am also it's very addicting the feedback the response the physical changes whether this is actually point two or three look good or feel good play good or it's even just part one you're starting to see that when you compare compare that to things like fat loss that Journey tends to be longer it's more difficult it's more relying upon other factors like nutrition Etc strength training is really about like there's some very minimal nutrition requirements outside that it comes down of the training and

00:12:44 the feedback is immediate that's powerful because if you look across uh the literature on exercise adherence you'll see that that is in fact the number one predictor of effectiveness of any training program so what that means is if you were to put any variable possible and figure out what is going to determine whether or not this program works um this is what we typically called the methods are many and the concepts are few so the methods of exercise the methods of strength training the method methods of hypertrophy training which

00:13:15 we'll talk about are are infinite however there are only a handful of key Concepts that you have to achieve in order for that program to work adherence is one of them and again is often the top one so you need to do something you need to do something consistently when you are getting that feedback and you're seeing results in your appearance immediately and you see that every single day every time you take off your shirt or every time you um look in the mirror you see that result that tends to drive adherence um really powerfully so

00:13:43 it's important to give people wins especially people who are not maybe like you and I who are like I'm going to lift weights and I'm going to exercise like no matter what the rest of my life because I just love it not everyone's like that and so giving them a little bit of carrot of success and if you can achieve that in you know say three to four to five weeks already um it's very powerful tool before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford it is also separate

00:14:08 from Dr galpin's teaching and research roles at Cal State Fullerton it is however part of our desire and effort to bring zero cost to Consumer information about science and science related tools to the general public in keeping with that theme we'd like to thank the sponsors of today's podcast our first sponsor is momentus momentus makes supplements of the absolute highest quality the huberman Lab podcast is is proud to be partnering with momentus for several important reasons first of all as I mentioned their supplements are of

00:14:34 extremely high quality second of all their supplements are generally in single ingredient formulations if you're going to develop a supplementation protocol you're going to want to focus mainly on using single ingredient formulations with single ingredient formulations you can devise the most logical and effective and costeffective supplementation regimen for your goals in addition moment to supplement ship internationally and this is of course important because we realize that many of the huberman lab podcast listeners

00:15:00 reside outside the United States if you'd like to try the various supplements mentioned on the hubman Lab podcast in particular supplements for Hormone Health for Sleep optimization for Focus as well as a number of other things including exercise recovery you can go to live momentus spelled ous so that's lives.com huberman today's episode is also brought To Us by

eight sleep eight sleep makes Smart mattress covers with cooling Heating and sleep tracking capacity I've been using an eights Sleep mattress cover for about

00:15:27 the last eight months and it has complet completely transformed my sleep I'm sleeping about the same amount but I'm sleeping far deeper and I'm now getting the proper ratios of so-called rapid eye movement or REM sleep and slow wave sleep and waking up feeling far more recovered mentally and physically the underlying mechanism for all that is very straight forward I've talked many times before on this podcast and elsewhere about the critical relationship between sleep and body temperature that is in order to fall

00:15:53 asleep at night your body needs to drop by about 1 to 3 degrees in terms of core body temperature and waking up involves a 1 to 3° increase in core body temperature with eights Sleep mattress covers you can adjust the temperature of your sleeping environment to be one temperature at the start of the night a different temperature the middle of the night and a different temperature as you approach morning Each of which can place you into the optimal stages of sleep and have you waking up feeling more

00:16:17 refreshed than ever if you'd like to try Aid sleep you can go to AIDS sleep.com huberman and check out their pod three cover and save \$150 at checkout eight sleep currently ships in the USA Canada United un Kingdom select countries in the EU and Australia again that's 8sleep.com huberman to save \$150 at checkout today's episode is also brought To Us by levels levels is a program that lets you see how different foods and activities affect your health by giving you real-time feedback on your blood

00:16:45 glucose using a continuous glucose monitor many people are aware that their blood sugar that is their blood glucose level is critical for everything from Fat Loss to muscle gain to healthy cognition and indeed aging of the brain and body most people do not know however how different foods and different activities including exercise or different temperated environments impact their blood glucose levels and yet blood glucose is exquisitely sensitive to all of those things I first started using levels about a year ago as

00:17:16 a way to understand how different foods exercise and timing of food relative to exercise and quality of sleep at night impact my blood glucose levels and I've learned a tremendous amount from using levels it's taught me when best to eat what best to eat when best to exercise how best to exercise and how to modulate my entire schedule from work to exercise and even my sleep so if you're interested in learning more about levels and trying a continuous glucose monitor yourself go to levels. link huberman

00:17:46 that's levels. linkhub let's talk about strength and hypertrophy if you would please remind us what strength and hypertrophy are in terms of the specific adaptation they represent what I mean by that is when somebody is training for strength what are they really training for obviously it means the ability to move more weight but I know that it includes a number of other things as well and when one is training for hypertrophy for the growth of muscle fibers what does that represent because I think if people understand that they

00:18:22 will far better understand the methods and protocols that are going to be best for strength and hypertrophy at its core you you've basically described it when we talk about strength we're talking about an actual function so can you create more Force across a muscle or muscle groups or or total movement and when we talk about hypertrophy now we're specifically referring to just an increase in size there's no actual mention of function so a muscle can grow larger without actually technically being stronger for a number of reasons

00:18:50 um however there is a strong relationship between strength and hypertrophy so a lot of the times in the general public in the lay conversations we sort of those two things in it's the same thing and so we have to recognize people who are new to training or people even are intermediately trained there is a huge overlap between strength and hypertrophy once you get past that though they become disentangled and a good example of it is this if you look at these strongest people in the world this would be people who compete in the

00:19:21 sport of powerlifting right that's a true test of maximum strength so it is a deadlift a bench press and a back squat and you're going to do a one repetition Max in all three of those and so whoever wins is the person who lifted the most amount of weight one time that's it it's not like World's Strongest Man where it is how many reps can you do in a row or your time right is a true maximal strength test and you compare those to say bodybuilders now both of those individuals are strong and both of those

00:19:49 individuals have a lot of muscle however it is extremely clear the powerlifters will be significantly stronger than the bodybuilders on average right there are individual exceptions but we're just talking Collective averages and the bodybuilders will have more muscle than the other ones in addition whether you look at Olympic weightlifting or powerlifting or world's strongest man for that matter there are weight classes and the reason is as you go up in weight classes you will always see the world

00:20:18 records go higher and higher and higher right so you can clearly get stronger without adding any muscle however there's a point right where you simp simply have to add more mass to get a higher number and that's why we have weight classes in those Sports and in Combat Sports and lots of other things so we have there's a lot of confusion right because people think man either

these are the same thing or if I want to get stronger I have to get bigger which is not the case at all another misnomer here is I can't get stronger unless I

00:20:51 add muscle that's not true either right this a similar idea so what what I'm saying is you have the ability to do whatever you'd like if you'd like like to get stronger and add muscle great if you add muscle you're probably going to bring some strength along for the ride however if you want to get stronger and you don't want to add muscle for any reason personal preference on Aesthetics whether you're in a weight class and you simply can't afford it it is quite easy to get stronger and not add much muscle

00:21:20 math either and so differentiating these two things is one of them is simply a measure of size and the other one is a measure of force and when we talk about strength what we're really talking about are two unique components component one is what I call the physiology so what what is the ability of the neuromuscular system what is the ability of the muscle fibers to contract and produce Force the other one is what we call mechanics mechanics is simply things like it's minutia down to how long your femurs are

00:21:50 relative to your tibia or or other things like this is biomechanics this is also technique this is skill this is how smooth you feel this is are you firing the right muscle group in the right sequence and Order and all of these things play into strength so somebody who maybe has U more Force capability in their muscle fibers but their technique and the movement is worse may lose in a competition or somebody again who's um like if you go into the world of speed and power especially you'll hear a lot

00:22:22 of people talk about like the Rhythm and there's just a certain Rhythm that has to happen if you want to jump as high as possible or run as F fast as possible but that's all mechanics at this fundamental level so when we look at hypertrophy it's just still simply about how big the muscle is so those are the the similarities and distinctions between strength and hypertrophy when strength improves and when hypertrophy increases is there also involvement in the ligaments and tendons that is of

00:22:56 course the ligaments and tendons are involved in the movements and but do ligaments and tendons themselves grow Andor get stronger this field is really difficult because uh connective tissue is not vascular and so their plasticity is significantly lower than skeletal muscle in fact if you look across all the organs skeletal muscle is one of if not the most plastic meaning it's the most pliable the most responsive um the one that's going to adjust it's basically it's paying attention to everything that's being said in the body

00:23:28 um you cannot change blood pressure or pH or um macronutrients floating around without muscle knowing about it it is uh in fact this is why we call muscle an organ people don't tend to think about this if you were ever on like Jeopardy and they ask you that question of like what's the biggest organ system in the body people tend to say the skin muscle is actually the correct answer all right well I'm going to cite you when I get it you probably get wrong je Jeopardy I don't have any immediate plans to go on

00:23:54 Jeopardy but who knows oh there you go Celebrity Jeopardy hry huberman wait uh I don't know about the celebrity part but Jeopardy would be fun um but I will say the muscle and I'll I'll if you get a phone call on Jeopardy I don't know I haven't seen that show a very long time yeah U maybe ever then I'll I'll call you but that makes sense um that muscles would be the largest organ system in the body the reason I saying that is so muscle is both listening and talking it is controlling uh the immune system a

00:24:20 lot it's controlling blood glucose regulation it is it is the central Depot for uh amino acids which are needed to things like regulate the immune system build um any new red blood cells a lot of this stuff is coming from skeleton muscles so when we say organ by the way that's actually like a physiological definition so something that's communicating uh to either another organ itself or uh throughout the system so it's listening and it's talking connective tissue is not the same way and so we do see adaptations with

00:24:50 strength training um in connective tissue it's just much lower it's difficult to measure um effectively what we know now is you're going to have a combination um of adaptations throughout the connected tissue it is beneficial uh this is probably one of the major reasons that's that strength training reduces injury risk which is very very important because people who tend to want to pick up an exercise routine after say 10 years um the the classic cliche is like I played all these things in high school then I went to college

00:25:19 got a job now I'm 25 or 35 or whatever and you sort of want to jump back into what you did when you're were 20 well there's no tissue tolerance left and what we almost always mean by that is connective tissue the tolerance in there is is not ready for the load you're about to handle and so you go through some movement and then boom sprains tears um you know even like the more significant ones are on ailles tear which is going to really sideline you so those are some of the problems and we know strength training has a a large

00:25:47 role in injury reduction for stress and strain and overuse injuries and that's specifically coming for the connected tissue adaptations again the difficult part here is it's very hard to assess we actually uh when I was a doctoral student we played around with Patel attendant biopsies so I actually had one this is like a there's a little piece of your Patel attendant missing yeah

because your own lab so now I've probably had I don't know how many hundreds of biopsies I've performed on people um probably well

00:26:16 over a thousand certainly well over a thousand I've probably had 35 or 40 done them myself um there's no problem here I have no Scar Tissue I have no loss of function and I've stuck needles in every leg like all over myself right quads uh my Solus gastroc like all up and down taking tissue out yeah you go with the needle looks like a pen basically and you you know you're live and you go in and grab a chunk and you pull it out and can I come to your lab and get biopsy absolutely yeah you're probably

00:26:42 looking under the microscope it'll just look like the molecule caffeine there's a there's a mutual friend of ours who came down and did that he's a big big big gentleman big in the lifting very into strength training uh and he went through that experience and he was like oh my God it was not what he was hoping to get he actually had unbelievable muscle morphology his fibers were um the diameter of muscle fibers is extremely large it's one of the biggest cells by volume in all the biology skeleton

00:27:11 muscle and human how large can't help myself um millimeters well you so you have length and then you have width right so lengthwise they can be extraordinarily long you can be the classic example is like your Sartorius which is like the front of your hip to the inside of your kneecap theoretically those cells can run the entire length which would be one muscle fiber running that thing um if I were to do a biopsy on you and I and I pull that tissue out I could actually pull an individual fiber out with

00:27:37 tweezers and hold it up and you could see that whole muscle cell yeah I'm definitely not going to be allowed to get biopsy um you'd be stunned how big they are anyways his was the size of a rhino so the diameter of his now he has a well documented assistance in the area of muscle growth we'll say MH um but yeah those can be large so what were we even talking about there well I was asking about tendons and ligaments because I'd like to understand the various tissues and organ systems that adapt when one gets stronger when muscle

00:28:05 tissue grows and I I I do want to ask about bone yeah um and here I'm not referring to Bone mineral density what I was going to ask is whether or not bone itself can grow and get stronger and the reason I'm asking is there's a favorite result of mine I have about 3,800 favorite results 3,000 pet peeves and 3,800 plus uh favorite results um but one of my favorite results is from Eric kendell's Lab at Columbia Eric won the Nobel Prize for learning and memory and his laboratory got really into the

00:28:34 effects of exercise on learning and memory yeah and they had this incredible result which is that loadbearing exercise yeah stimulates the bones to release something called Al osteocalcin excuse me and then osteocalcin acts as a more or less a hormone travels to the brain and enhances the memory systems in the brain by enhancing neuron Health that's the basic Crux of of the studies there were several of these and The Moment I Saw the first of those studies I thought well here's another reason to do resistance type exercise

00:29:06 and not just aerobic exercise and then it brings to mind whether or not bones themselves get stronger when we do resistance training I don't know the answer to that yeah that's very clearly demonstrated and we've known that for many decades um you have a diminishing ability to do so with age uh particularly you need to do this in your teens and 20s this is where you're going to have the largest ability to enhance um bone mineral density and it's particularly responsive to axial loading now I'm a muscle guy I'm not a bone

00:29:37 specialist so we would have to consult somebody that can give you more Precision here but that's you explain axial loading it's up and down it's vertical okay so it's almost like a like a cylinder putting weight of the on the small end of the cylinder on both small end of the cylinders if someone doesn't do this in their 20s or teens however can we assume that some degree of positive change will occur if they do resistance training even if it's a small fraction the answer is yes it is small

00:30:04 um we have worked with a number of women in our um our rapid health program that come in and they are in their 20s and they're in their 30s and they have significant bone Minal density problems and eight months later we can see noticeable changes that are outside of the measurement error of of a dexa positive changes positive changes correct and if you worked with the there are many Physicians that specialize in this area you you're going to need a Nutri nutrition here um strength TR loone is probably not going to get you

00:30:33 there particularly with women because you have to figure out why and and there's a lot going on with the physiology and biochemistry so you probably like almost surely need to have some blood chemistry done with that um you have to figure out what's going on menstrual cycle wise in fact like oftentimes what we'll do for our women very specifically is we use a thing called The Rhythm plus a 30-day test so you can actually do a salivary test across the entire menstrual cycle and you can take uh samples it's about every

00:31:01 other day so you'll get 15 or 16 samples and you get a really beautiful picture of what's Happening hormonally across the entire menstrual cycle and that's really really important because typically for women uh if you get a single sample or simple time Point whether it's salivary urine or blood you can have um well like a order of magnitude difference in in any number of

metrics because of what phase are in this is one of the many reasons why it's been such a challenge to do a lot of physiology research with females um some

00:31:31 metrics change throughout the menstrual cycle others don't like strength is a very good example I can strength train and I can do a one rep max test on a woman at any point I don't have to do that at a certain phase of their menstrual cycle because it's it's the evidence I think is pretty clear at this point that number won't change so I have no qualms including females in any of my studies where strength is an absolute is an important dependent variable because I don't have to adjust around menstrual

00:31:56 cycle other factors like anything in blood anything hormone related you're going to have to automatically account for it so what I would say is those folks should absolutely work with a qualified physician um and and you you're going to have to get some nutrition supplementation potentially uh and then maybe even some other stuff going on to make that even more complicated if you're on any form of birth control or not that's going to change the entire equation especially if it's a hormone based birth control so it

00:32:24 just gets really really complicated um to answer it though you can see adaptations they are significantly diminished U relative to if you would have started in your teens and 20s but there is hope you just need to work with somebody who specializes in that area so for both men and women boys and girls what are the major adaptations that occur to underlying improvements in strength and if you would if you could just provide a bullet point list of that and then we can dive into each of those in detail for instance

00:32:59 our nerves getting more efficient at firing our bones enjoying adaptations in different yeah bone connective tissue relationships that that underlying strength I have to imagine all of these things are happening but what are the major changes that are occurring in those organs and organ systems that reflect someone's ability to on one day lift you know 100 pounds and then a week later to lift uh 105 pounds now I'll try to keep this condensed again this could be an entire University of course um I will

00:33:30 also try to give you a little bit of Bones here so normally as a muscle guy I only take all the credit in muscle turns out the nervous system gets a little bit of credit too here thank you so as we walk through it just in as a big picture if we think about again what causes human movement basically everything along that chain will improve a strength training and I'm not really being using too much hyperbole there it's quite impressive so just going from the nervous system the equation what has

00:33:59 to happen for human movement is a nerve has to send a signal through a motor unit now a motor unit uh is comes down and inates multiple muscle fibers so if you think about your actual muscle it's not a thing it is a component of many individual muscle fibers so you've got millions if not more um think of it like a ponytail so we collectively say ponytail and you think of it as like one thing but really a ponytail is a combination of tons of individual hairs okay muscles the same way so this motor

00:34:26 unit comes in and innovates a lot of different muscle fibers now every one of the fibers in a motor unit is generally of the same fiber type so fast twitch or slow twitch and they are not laid out next to each other in the muscle they are spread out across uh horizontally vertically as well as um closer to the Bone and further to the surface so they're they're moved throughout the entire way and this is what allows you to have smoother contractions and you don't have specificity and things like

00:34:49 that so we see improvements from the neuromuscular side like firing rate we see synchronization improvements um that that are coming in you all also see um improvements in things like acetylcholine release from the presynaptic neuron um so you're getting it faster we see calcium recycling is improved back uh to their so in in order for without walking into too much of the biochemistry in order for a signal to go from nerve to muscle there's a little bit of a gap there's a physical space that happens and what happens is you

00:35:18 release this molecule called AC cocoline this goes into the postoptic CFT and then that actually binds to a receptor that receptor actually opens up a door that lets sodium in that's really what's happening so it's not theine well that aceto cooline then sits on that receptor site it's broken down put back in and recycled back up in the preoptic nerve site the faster you can do that the faster you can recycle that signal and so almost everything that I described in that entire system improves and has been shown to to to

00:35:49 increase with training so that alone is given to give you benefits we haven't even walked into getting from an electrical signal now into an act potential which is going to cause a muscle contraction so getting from nerve into the muscle we see everything from improvements in way call contractility which means the muscle fiber themselves can produce more force or more velocity independent of muscle size changes so this is another component when we ask like well how is that I got stronger without getting bigger well in the

00:36:20 muscle fiber itself its ability to contract Force increases and this because we have everything like the sarcoplasm reticulum which is the Place stores and releases the calcium which is what's needed for this entire crossbridge interaction from the meas and an actin um to happen I know a lot of I just lost a lot of people but you can go look at some of these images the Saras

matrium gets uh gets activated more it gets more sense it is better at releasing calcium bringing it back in and doing it again um the bond between

00:36:49 the crossbridge the mein and actin gets stronger um the calcium Affinity is the phrase that we use there um increases so we we're literally walking through almost the entire process of skeletal muscle contraction here and every step along the way we see Improvement so that net result is we see again more Force production independent of any change in size independent of any increase in contractile units we didn't add anything to the equation we didn't change size we did nothing but improve efficiency uh effectively independent of

00:37:21 that now we can actually start talking about changing muscle fiber type so we can change our fibers from a slow twitch fiber to a fast Twi Swit fiber that alone is going to give you more Force production again independent of size fast switch fibers tend to be larger than Soul fibers but not always especially in the presence of endurance training so if you do a lot of consistent endurance training it's very common for us to find solo fibers that are as similar size if not larger often very often larger than the fast TCH

00:37:50 fibers if you big slow fibers big slow very metabolically effective fibers so extremely fatigue resistant so it's not a bad thing to call them slow it's like we tend to say fast and slow and SL slow has this negative connotation but it's a quite healthy like fiber type to have um outside of that now we haven't even gotten into things like pen angle so this is the angle at which your muscle fibers interact with your bone so we tend to think about this as like a muscle fiber is pulling on a muscle well

00:38:18 some of these are oriented at almost a 90 Dee so a fiber runs perpendicular into the bone and some of them are closer to like a 45° and some of them are closer to almost parallel and that confers a lot of unique mechanical benefits so in one area it's actually going to increase Force production you go the other direction increases velocity and so we have all kinds of changes in the angle at which the muscle inserts into the bone now we're already in the mechanic side of it right so we've we've influenced how effectively

00:38:46 it pulls um and with any of these things it's always a give and take so you're going to give up in the case of pation angle you're going to give up strength but you're going to increase Vel shortening velocity or if you want to increase the velocity you're going to give up sort of the strength right um we haven't gotten to any of the energetics at all so we haven't talked about increasing storage of phosphocreatine which is the energy uh system needed to power that muscle contraction at the fastest possible rate so we could

00:39:11 continue to go as long as you want here but uh hopefully you're getting the point of a little bit of the of the adaptations that occur um the reason I want to actually why I think that stuff is important to bring it back maybe for some listeners I know I took you on a journey there and you're just like what the hell just happened that matters because again this is the specific specific explanation for how is it possible that I got stronger but I didn't get bigger and this is also why strength and hypertrophy are intertwined

00:39:36 and are heavily overlapped but are not necessarily the same thing so for example we can increase muscle size and actually reduce strength because of what's called lattice spacing so what happens is um you have to kind of remember your muscle fibers are these long cylinders and the way that they contract requires an optimal space and so what happens is you this molecule called actin and you have this molecule called um mein myosin sits in the middle and there are six actin that surround each individual mein um in a

00:40:08 three-dimensional Circle here so you got a A mein in the middle that has all these globular heads and they can reach up and grab an actin and again there's six sort of around them right um well one of the things that can occur is if those those actin are too close together so imagine my hands um I'm I'm reaching out and doing a giant te right so I'm horizontal out there well if my fingertips are the tips of the mein and I'm trying to reach up and grab an actin and I want to pull those actin closer to

00:40:35 my face well those actin stack on top of each other and that's what actually makes your muscles grow up like if I flex my bicep it actually you know grows up three or four inches because you're stacking these these ccle mirrors or what they're called on top of each other all right great well if I'm reaching out to grab them and the muscle is stretched too far I can't actually make that strong of a connection it would be like if I reached out grab something but I can only reach my longest fingertip on

00:41:00 it when I go to contract I can't make that strong of a contraction because my grip is weak my grip's going to break before I reach my strength limit if I'm too close there's nowhere to go I'm already as close so if you actually disrupt that L of spacing too much you can actually lose a little bit of strength um so it's not that getting bigger will ever make you weaker it's simply that you're not optimizing for strength You're simply optimizing um for size and so that can that can explain a little bit of the of the discontinuity

00:41:29 between growing and performance I'd like to take a brief break and acknowledge our sponsor athletic greens athletic greens is a vitamin mineral probiotic and adaptogen drink designed to help you meet all of your foundational nutritional needs I've been taking athletic greens daily since 2012 so I'm delighted that they're a sponsor of this podcast the reason I started taking

athletic greens and the reason I still take athletic greens once or twice a day is that it helps me meet all of my foundational nutritional needs that is

00:41:59 it covers my vitamins my minerals and the probiotics are especially important to me athletic greens also contains adaptogens which are critical for recovering from stress from exercise from work or just general life if you'd like to try athletic greens you can go to athleticgreens.com huberman to claim a special offer they'll give you five free travel packs and they'll give you a year supply of vitamin D3 K2 again if you'd like to try athletic greens go to athleticgreens.com huberman to claim

00:42:24 the special offer what are a few of the main major changes that occur in muscle nerve Etc when we experience hypertrophy I've heard of protein synthesis yeah changes I'm assuming that's true maybe you can tell us a bit more about that changes in blood flow yep perhaps changes in neural innovation uh who knows maybe even changes in fascia I I'm not aware of any specifically but um I have to imagine that they're somehow involved sure so the when we talk about hypertrophy a lot of the adaptations are going to be

00:43:02 similar because the mode of training is close enough um so your nerves probably aren't smart enough to differentiate between a set of five reps or a set of eight repetitions they're smart enough to differentiate anything like they know everything that's going on U but it's going to be a huge overlap the primary difference with hypertrophy is a couple of things so if you think about the muscle micro structure um I I have a whole series of videos on YouTube if you want to see the visual behind

00:43:28 this in fact in there I include the specific diameter size of muscle fibers that I was failed to give you a few minutes ago okay we will provide an active link to this great so um what happens is this when we talk about and you hear this classic Buzz phrase of muscle protein synthesis generally what we're talking about there is is contractile units and so when we say contractile units we're talking about the meas and and actin and so what we're really trying to do is say okay there's some amount of protein turnover where um

00:43:56 we're coming in we're trying to add more proteins to the equation and so what has to happen there is a series of steps so step number one is there has to be some sort of signal from the external World um this could actually often times it's things like stretching of the cell wall which is what happens with exercise right so you're Contracting you're shortening you get this big stretch of the cell wall it can come from as simple things like an amino acid infusion this is just eating protein this is why

00:44:20 protein ingestion alone is anabolic right it will help you grow muscle independent of even moving so just eating protein will grow your muscles yeah certainly uh and those those data are are very clear um of course like anything there's a saturation Point uh in terms of total amount you need to get to and and things like that but yeah if you were to walk into a laboratory fasted overnight and I gave you 30 grams of protein we would see a very immeasurable increase in protein synthesis um quite clearly for several

00:44:48 hours probably four to five plus hours um we could maybe bring us some people that would know those data better but many hours later with no weight training correct I embedding that most people are not aware of that fact you know what's actually interesting about it is um if you do the exact same study again and you just did strength training you would also see an improvement in protein synthesis right but those factors are independent and the mechanisms are independent such that if you do them

00:45:12 both together they stack on top of each other which is really wonderful and if you were to add carbohydrate into that mix now you're actually adding fuel for the the entire M muscle protein synthesis process uh and now you're going to see even added benefits and this is why for so many years uh this is what bore the whole like post exorcize anabolic window thing which is like you got to get carbs and protein in post xraze to maximize um mostly P now that turned out to be like not totally true in terms of the window turned out to not

00:45:40 be as strict as people initially uh asserted as I recall but still I think that's super interesting these are parallel Pathways for for protein synthesis simply eating protein um or training each independently increases protein synthesis uh I can't help but ask is the same true if one does end endurance type exercise if I go out for a 45-minute jog um where I can nasal breathe the whole time but if I were to go any faster I would have to kick over into mouth breathing as well so- called Zone 2ish cardio uh will I see an

00:46:13 increase in protein synthesis as simply as a consequence of that jog no this is one of uh the unique factors of strength training you're not going to see that in fact you would it's difficult to measure protein breakdown that's been as extraordinarily challenging to do in the laborat but you're not going to see those benefits in fact you're going to see quite the opposite it's it's an entire molecular Cascade um so this is kind of how it works so you have to have some sort of signal on the outside and

00:46:38 this can be an energetic signal um so this could be glucose uptake it could be protein intake uh it could be a physical stretch um what happens is on the cell wall there is some sort of it could be testosterone right testosterone combine to Beta adrenic receptors and this activates a whole series of Cascades of signaling proteins and these proteins basic play a game of

telephone so one tells the next one they tells the next one and they sort of walk through this entire way well that molecular Cascade

00:47:04 is fundamentally the same thing whether regardless of the insult but they're different Pathways and so the pathway from strength training or protein ingestion is going to go to the same nucleus it's going to activate a whole set of Gene Cascades that are going to tell you to go through this entire process of protein synthesis which I'll walk through without that is in a second if you do endurance training it's a different pathway and so instead of activating this entire thing of like mtor and akt and this this anabolic

00:47:29 signaling Cascade it's going to do a different one um which you can think of more of like as amk um and energy signaling things so there's a crossover Point here in fact what one of the things you'll notice is mtor and akt don't really influence mpk but there is some literature that years ago showed mpk will activate another protein called um tsc2 and that will actually inhibit mtor and that was the first molecular explanation for the quote unquote interference effect of endurance training on hypertrophy could you just

00:48:00 highlight for people what this is because as you describe these signaling Pathways I just want to um maybe just put a a top Contour explanation the mour pathway is synonymous with cell growth yeah both during development as organisms humans included mature and cells get larger mtor is abundant in the system just to put it quite simply and then the amk pathway and some of the metabolic signaling that you're referring to is more Anonymous with cardiovascular exercise in this at least in the context of this discussion and

00:48:32 fuel utilization Y and what you described as a crossover point where certain forms of exercise can tap into both of these yeah but at least for sake of this conversation we're we're largely separating them yeah because the the byproduct is the thing that that matters here so the result of um mtor and akt getting into the nucleus is going to be increased in protein synthesis the result of ampk running down to the m is going to be result in increasing mitochondrial biogenesis so the net outcome is different

00:49:06 now I I do want to flag it very quickly this is an extraordinarily complicated thing and um in fact in our laboratory we were able to to be one of the first that figured out how to measure all the different subunits ofk in individual muscles by fiber type so that's because you're ripping people's muscles out of their knees and their patellar tendons uh so just teasing they they're gently removing with under IRB protocol of course um so even when we say something like amk it's not one thing and we say things like mtor it's

00:49:37 not one thing either it is you have the total amount that matters you have the activation the activation sites are many of them so it's not as simple um as what I'm laying it out I just want to get a big concept of kind of what's Happening Here to to actually kind of answer your question which is okay so how is the muscle actually grown what you have to understand is is a little bit of how um protein synthesis occurs so what I'm generally meaning is you have a whole bunch of amino acids and this actually goes back to maybe

00:50:06 like middle school biology class right so if you take a bunch of amino acids and you combine them together we get these things called a peptide right and if anyone who's ever heard of like peptides that's all it really means you put a bunch of those together you have a poly peptide you put a bunch of those together and we now have a protein so any protein I want to make is going to go through the ex exact same system exact same steps it doesn't matter if that protein is going to be a red blood cell it doesn't matter if that's going

00:50:34 to be a hair follicle doesn't matter if it's going to be skeletal muscle that's basically protein synthesis so when we tend to think of protein synthesis we we just paint this picture of growing more muscle and that's not the only thing and so when we talk about the benefits of having highquality muscle is being this place that's going to regulate most of your protein synthesis we tend to lose some people because they're thinking oh I don't need to gain muscle and that's not what we're talking about we're

00:50:58 talking about regulating the immune system we're regul we're talking about regulating any protein turnover so any Protein that's degraded or needs to be broken down in your in your system at all autophagy this is the like this is such an important buzzword um that's just protein breakdown of of an unneeded or or damaged protein right that whole thing is going to go through protein synthesis to be able to come back and replace the things the only reason you go through autophagy is so you can clean

00:51:23 that garbage out and then come back and build in a more properly functioning protein so it's not just about growing more muscle mass it's why you want these systems to be operating well so the protein ingestion is going to just activate that Cascade because it's basically saying oh hey look we have an abundance of Supply here why don't we make something out of it because we don't know the next time this thing is going to be around um carbohydrates and fat are very easy to store protein is very challenging it's more transient and

00:51:52 so you can store some of it and keep it around but most of it you're going to lose and so when it's a available your your body wants to act very quickly it doesn't necessarily care if you have extra fat floating around in your system it's all right let's just package it up and store we can easily bring this back out but if you got protein around you're going to want to use it and so that's

why it alone will activate and increase protein synthesis um independent of exercise so those effects are additive

00:52:16 like I said because that signaling process is independent and once you hit a rate limiting phase then it you are you're there but at its onset those things will work independently okay so that being said what is skeletal muscle hypertrophy in general we think about it as this increases in contractile protein so those myosin and actin eff effectively get thicker okay now what happens is since they are thicker and as I talked about a second ago that influences and actually hurts the L of spacing and so

00:52:44 what your body does as a result is say hey let's increase the diameter of the entire cell so that we can maintain our spacing between these things right it's effectively like if if you know the two of us were sitting in this room and you doubled in size and I was like whoa you're in my personal space like and I double in size now we're in each other space the at some point we just have to make the room larger and that's exactly what's happening in the cell and so as you can continue to increase muscle size you're

00:53:11 going to muscle my fiber accretion you're going to continue to increase muscle fiber size for years there was this other comment about um nonfunctional hypertrophy and this is often called sarcoplasmic hypertrophy now this is not sarop particu this is a fancy way of saying my muscle is larger but it has no function and the question would be well how the hell is that possible if I have more contractile units and I can make more of these cross Bridges perform more of these power strokes this is what

00:53:40 these contractions are called how could I possibly be losing function well that was challenged for that was broscience for a very very long time in fact where it really came down to was are there different types of hypertrophy training some that induce contractile protein hypertrophy and some that induce the sarcoplasmic hpy and that was significantly challenged and tell recently Mike Roberts did at Auburn did a series of wonderful studies that showed quite clearly that sarcoplasmic hypertrophy is probably happening um and

00:54:11 in fact there's probably a pretty easy explanation in general what happens is it is it is a increase in fluid uh in the muscle fiber and so this would allow for the diameter to be larger but since there's no addition of contractile units no more Force production happen happens and so he actually has a wonderful review paper I believe it's open access where you can go look and he created a wonderful graph um I think that's in in my hypertrophy videos on YouTube as well and you can actually see that it's

00:54:38 likely happening in phasic changes throughout your training experience so at the beginning of your training but as as the years and year or weeks rather than months and then eventually years go by in your training we have a change in the hypertrophy that's coming from uh contractile units versus ccop plastic um so I think that is it's an important note because again people are wondering like well how the hell is it even possible for me to get larger muscle and somehow I'm not stronger well if it came from

00:55:04 Simply fluid retention and this is not bloating this is not there's no negative really to this it is simply um holding of of more hydration in the cell the Amor gets larger and then everything works that way what you just described calls to mind something similar in the nervous system which is neuroplasticity which of course is the nervous system's ability to change in response to learning and experience and damage for that matter yep and we think about it as one term but there are many different forms of

00:55:31 neuroplasticity yeah uh a discussion that we don't need to get into now but there Spike timing dependent plasticity and LTP and long-term depression which has nothing to do with psychological depression and on and impaired pulse facilitation and on and on and on and short-term plasticity and so what I'm starting to understand is that there are many paths to what we call strength increase and there are many paths to what we think of as hypertrophy many of these are going to operate in parallel it's going to be rare that any one of

00:56:00 them is going to be active alone Y in order to create hypertrophy or strength changes and that certain forms of exercise and certain ways of doing exercises in terms of sets and repetition schemes and rest intervals between sets and between training sessions are going to tap into different mechanisms but also overlapping sets of mechanisms which is why if I understand correctly you mentioned at the beginning that often not always often strength increases are associated with some hypertrophy changes and hypertrophy

00:56:33 increases are often not always associated with strength increases do I have that right correct and the beauty of this whole thing is while we don't yet know the mechanisms specifically and there's a lot of confusion And there's a lot of changes that happen there's a we actually just submitted a paper a few days ago um myself uh Jimmy bagley at San Francisco and Kevin mck at one has a wonderful muscle physiology Lab at Arkansas and we we we actually this is a very lay article actually it's incredibly easy to read um we describe

00:57:04 the the role of my nucleation in uh muscle hyper and there's actually a lot of interesting stuff we can get into there but um we we're learning more and more about it uh as a quick example so skeleton muscle is unique in the fact that it is so large in diameter it's also unique in the fact it's multinucleated what that means is um typically in biology you see like a cell has one

nucleus that's the place that houses and holds the DNA and it's a control center does it to grow shrink die repair that whole thing well

00:57:34 skeletal muscle in human is awesome because it has thousands if not more of those nuclei which gives it that plasticity and so a normal cell has one place it has to go to for any time it wants to up regulate down regulate do whatever the thing is your muscle fibers have these little control centers all throughout them and for years we were like okay great the amount of hypertrophy that you can experience is probably limited by the amount of nuclei you have because you're not going to exceed a certain size of muscle fiber if

00:58:06 that's going to mean you lose control and so we're like okay great we found and identified a limiting factor to what will determine how much a muscle can actually grow and then the next question was and then where are these things coming from and and this is where satellite cells came in and so was very clear a satellite cell that's lying dormant sort of on the outside the periphery of the fiber will then go in um into the into the Fibber will turn into a my nuclei and then it can actually you know increase your diameter like that

00:58:33 and so then actually it was like hey hey you're actually limited by the amount of these satellite cells you can get in and turn into nuclei and then what the evidence came out that showed hey what if you detraining so what if I used to lift weights like a long time ago and I got big but now I've lost a lot of my muscle if I train again you actually get that muscle back faster than it took you the very first time to build it like that's what we call muscle memory like in our now on your side of the equation muscle

00:58:58 memory is something different right it's a neur when people talk about muscle memory um like the ability to ride a bicycle after so many years of not having tried to ride one that's actually largely independent of the muscle it has something to do with the muscle it's it's basically a nervous system phenomenon so muscle memory uh has been co-opted uh by different communities to mean different things on our side muscle memory is going to mean that ability to remember that muscle size right that Hy because as you

00:59:28 explained the motor control thing is it's a totally a nerve thing this is the one I'll give you this one you guys the nerve people can have this one well it seems to me that there are a tremendous number of parallels between strength and hypertrophy changes and neuroplasticity this is coming up again and again in this conversation um because we know for instance that if you are exposed to a couple of different languages early on in life you will learn any number of different languages far more easily

00:59:55 later in life and that's because there's some crossover between different languages especially Latin based languages that allows for that there's a substrate for it it's similar to the the ability to hop on a bicycle again phenomenon or play an instrument phenomenon but it's broader than that and again I think this speaks to the huge number of different adaptive changes that are occurring in the cells and in the nerves that inate these cells when one experiences increases in strength and hypertrophy so to to round

01:00:21 that out um and to go back to what I was saying there what we're actually learning now is that nucleation thing and by the way this entire trajectory of story is probably over the last like 8 years like this is how fast we've changed our understanding of how muscle grows uh the copos colum thing five years ago was was broscience now it's it's pretty well established the M nucleation thing was 8 to 10 years ago it's changing every week this paper we just submitted this week showed actually um why we had generally thought a few

01:00:51 years ago and in fact you can find me on podcasts and probably in some of my videos talking about this and I'm going to tell you right now those things are wrong like we've just had new things come out in these last couple years where that draining effect we thought was a reason of well what happens is if you had the muscle before and you brought in these nuclei and they differentiated and turned into into a nuclei and then the muscle got small again you preserved those nuclei and that's why when you go to train again

01:01:18 they were already around so the muscle grows faster the second time than it did the first time well now that looks like that's actually not the case in fact it's actually probably H what's happening is it's a it's a epigenetic change um in the nuclei's ability to access the DNA needed to grow muscle it's effectively the analogy we used it's the nuclei are remembering how to ride a bike so it's quite funny that you said that because it's not really necessarily that they're being preserved over time they have learned the sequence

01:01:48 it takes to grow the protein there and it goes it happens faster the second time and we've also learned that there are specific nuclei we've known this for actually a while we found this in our lab we didn't Discover it we just we saw this in in our sum of our HS but there are different shapes the nuclei some are more oval some are more elongated and the shape determines a lot of the function some of them are hanging out more towards the periphery and some of them are hanging out right around the

01:02:13 nucleus well it looks like there's actually probably different types of nuclei um a lot of them that are specific to the mitochondria in fact you can see like on some of the Imaging we have we just like they're just packed around the the m Andria and there are some that are probably specific to injury repair and so this is probably explaining a lot of the the individual

variation I mean I know you've You' said previously like you're just a very you're very slow at recovering there's a lot of things that go into that and I

01:02:40 would I would love to walk through sort of all the buckets uh maybe later into recovery but one of the inherent genetic variations is could be simply that you maybe have more or less of the nuclei responsible for tissue repair um that's something that's been happening the last like handful of months that's been coming coming out we'll see if that holds up is true or not um so as we're learning more and more almost every day about muscle physiology what's super fun and interesting and I think the most

01:03:07 exciting what to do inms in terms of like how to train and how to eat and how to do everything else to get these adaptations has been pretty well established for a long long long time we're just figuring out how like what's happening in the muscle now but we know what to do so from a practical standpoint putting together protocols um for any outcome that you want or don't want for any modality you don't have a gym you have uh weights you have dumbbells only you only have kettle bells you don't want to you only use

01:03:40 body weight we can you only have three days a week you have seven days a week you want to maximize muscle growth you want to get a Little Bit Stronger any of these variables you want to throw at me um we have a large evidence base for exactly how to get those adaptations and not others so um while we have a lot to learn about the mechanisms the physiology um we have pretty good legs to stand on in terms of what to do to get whatever adaptations you want so what are the essential components of an

01:04:02 effective strength and hypertrophy protocol okay so what I would like to actually do is walk you through both of those because as we mentioned before they overlap uh but the training needs to be differentiated so that you can optimize either strength hypertrophy or if you actually want you can get a combination of both this allows you to then get the adaptation you want avoid ones you don't want and then get it even a combination if that's the preference so a lot of people will talk about I want to get a little stronger I want to

01:04:30 add some muscle that's a different answer than someone who wants to truly maximize muscle which is a different answer from somebody who maximizes wants to maximize strength which is a different answer from somebody who wants to maximize strength but not actually gain muscle so we have all these combinations what's important to understand before we get into the details is a couple of things number one we we've been teasing this concept so far of the concepts are few but the methods are many and so I want to hit

01:04:55 those Concepts right now these are um as you as you say these are the non-negotiables that have to happen in any training program and I'm going to referring to these in the strength and hpy conversation but these are true of power development speed development muscular endurance uh endurance any other thing these are things that just have to happen for any training program to work I mentioned one uh a little bit earlier which was adherence and so that my um frequent collaborator Dan Garner will constantly say consistency Beats

01:05:26 intensity um again in fact the literature will show you very clearly in herin um is the number one predictor of physical fitness outcome so we want to do something that you will engage in will you'll put effort into and you'll be able to repeat consistently over time so that's number one the second one is and this is a major reason that people don't hit their fitness goals in fact I would argue outside of not doing it the number one mistake they make is Progressive overload so I'm going to walk you through through exactly how

01:05:57 much you should be increasing um your sets and Reps and weight Etc per week per month later but that's the biggest thing you have got to have some sort of overload the body works as an adaptation mechanism right so in fact um we we talked previously about the harvor fatigue lab and one of the things actually people don't realize is the concept of homeostasis is actually comes from research at the harbard fatigue lab it was um work that they did on an endurance Runner I forget name and they sort of realized that after a long

01:06:28 period of time working out this is an acute exercise spout the body actually comes back to some stable place despite the fact he was continuing to work and that's exactly what bore the phrase steady state uh and that actually then they launched off they said wow there's this state that the body wants to be in and we'll call this homeostasis so that those all Concepts came out of exercise physiology which is really really cool right um we don't get a lot of love a lot of times scientifically but that's a good one

01:06:53 that we took so why that all matters is we have got to achieve some sort of overload without uh going excess so we'll cover that later of exactly what to do and we'll get potentially get into overtraining and monitoring and maning things like that but you have to have some sort of consistent predictable overload that's what's going to cause adaptation to continue to cause stress if you don't do that you can still do things like burn calories you can still get some of the other benefits of exercise like improved mood cognitive

01:07:23 function Etc ET flexibility increased es all those can happen without a progressive overload but if you want to see these gains in strength and hypertrophy you really need to progressively overload so that's concept number two the third one here um is is going to be individualization and this is when we can get into things like personal preference you know

equipment availability you have kettle bells or dumbbells or you only have bands or you have none of that um these are all smaller details but that's an important

01:07:53 component to it the last one I really want to get into is picking the appropriate Target and we went through this when we talked about the fitness protocol and if you run through something like that and you run some testing and figure out where your biggest limitations are that's going to help you identify where you need to go um so if you can do all those things you're going to be in a good spot to balance specificity and variation all right so if you want to make sure you grow your biceps you better make sure your biceps

01:08:24 are working having said that if you over rely on specificity you're going to increase the likelihood of overuse injuries which is going to come back and actually hamper consistency over time all right so this is when hedging towards specificity is important but too much can cause a problem if you go the other direction and you go too much variation so imagine you're just sort of doing all kinds of different exercises every time you work out that's actually not enough stimuli directly on the muscle or muscle groups or movement

01:08:53 pattern if you're wanting to learn a new movement um to get you very far and so this is a classic problem of I'm doing a lot of work but I don't have a very clear Direction I lack specificity so I'm working but I'm not seeing a lot of improvements and this is like in the business worlds Etc this is like doing a whole bunch of different things means you get nothing really done so that's the game we're going to play here right how do we overload this stuff how do we make sure we're balancing specificity

01:09:17 and variation how do we make sure I want to do this and then how do I individualize it for my needs and circumstances and movement restrictions and time availability and my calendar and desires and all these things so those are the concepts we absolutely have to hit the methods that we choose run across a handful of variables and we call these things modifiable variables because as you modify them or you make different choices within these variables you get different outcomes or adaptations this

01:09:48 is exactly what determines the nine adaptations that we've been talking about so the way that I like to say this is extra exercises do not determine adaptation so you can't simply go I want to get stronger therefore I'm going to choose these exercises that's not how it works what determines adaptation is the execution of the exercises so a deadlift is my favorite example a deadlift is a common um example that people think of when they want to choose a lower body strength exercise but a deadlift will

01:10:20 not increase your strength unless you're executing it in the proper fashion I'm not only talking about technique here I'm talking about these modifiable variables the same thing for power exercises we'll commonly see mistakes of doing uh activities like a box jump which is great people think oh I'm going to get improve my power which we know is extremely highly correlated to um activities of daily living and particularly living unassisted as you age right is reduction of power so they'll do an activity like a box jump

01:10:49 what they're failing to realize is unless you do it powerfully you won't actually increase power um if you don't move fast you won't get faster so the the way that we manipulate these variables is everything to determining the adaptation you get or again don't get so with that Foundation I think we can kind of run right into these things uh and we can start off with perhaps speed and power and what what I would like to do is walk you through all those modifiable variables uh what to do with

01:11:20 them and then hit you with as many different methodologies as as we really have time for uh and then we'll move on to strength and hypertrophy and kind of round the entire thing out and then maybe at the end we can talk some other variables like what happens if uh I have a training protocol and I'm halfway through it and I can't finish my workout what should I do reduce my weight or reduce my duration or things like that so there's lots of what if scenarios that we can go through that potentially

01:11:46 uh a lot of people listening have questions about so sound like a plan sounds like a plan I'd like to take a brief break to acknowledge our sponsor inside tracker inside tracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate and long-term health and well-being can only be analyzed from a

01:12:13 quality blood test one issue with a lot of blood tests and DNA tests out there however is that you get information back about various levels of lipids and hormones and metabolic factors Etc but you don't know what to do with that information inside tracker makes no what to do with all that information exceedingly easy they have a personalized platform that lets you see what your specific numbers are of course but then also what sorts of Behavioral dos and don'ts what sorts of nutritional changes what sorts of supplementation

01:12:39 would allow you to bring those levels into the ranges that are optimal for you if you'd like to try insid tracker you can visit insidetracker.com huberman to get 20% off any of insid tracker's plans again that's insidetracker.com huberman to get 20% off so just to interrupt briefly and make sure that I and everybody else have in mind the proper nine adaptations that we've been

referring to and that were discussed in detail in episode one I have listed number one skill and technique number two speed number three

01:13:11 power which is speed times Force number four strength number five hypertrophy number six muscular endurance number seven anaerobic capacity number eight maximal aerobic capacity and number nine long duration steady state exercise yep you nailed it thank you for that it was probably important clarification for everybody um so that being said let's jump right into to speed and power now I'll do these a little bit simultaneously uh they are different if you're a high performance athlete you really need to separate

01:13:47 these two things for the most people though we can probably think about them is is the same thing there's not a lot of pure speed training that the general public is interested in um if you want to actually further breakdown speed there are multiple components there's acceleration there's top end velocity there's change of direction or agility things like that so we'll just kind of call All That speed and power for now now at the onset there's this three to five concept that that we talked about

01:14:14 uh many times where this is really fairly true for speed power or strength now I didn't develop the 3 to five it's just an easy way to help remember one concept that will run true across all these things so 3 to five refers to three to five days per week uh pick three to five exercises and you're going to do three to five repetitions per set you'll do three to five sets and you'll rest three to five minutes U between each set if you do that and you execute any of the exercises that you choose at a high

01:14:54 intent and that part is critical you don't get faster by moving kind of fast you can't improve Power by moving like eh powerfully you have to be trying regardless of whether you're actually moving faster or not anytime you're talking about speed or power you're by definition using sub maximal weights so you're going to be able to lift it that's not the question the question is how fast can you lift that Implement and so intention is incredibly important so if you do that the same for strength by the way so if

01:15:25 you land on that that allows you to run the gamut from as little as three days a week you're doing a three exercises you're do three sets of three which is a very low volume it's a very low amount of days easy to handle all the way to five sets of five of five exercises five days a week so it's again it's just one sample that's something easy to remember and is quite effective for a very long time and this has been tested quite extensively in both the coaching Realms as well as the scientific Realms to be quite

01:15:59 productive and and easy to follow and grasp if you do that all you need to do is slightly increase the load um or the volume but mostly the load over time and the number we want to look for there is something like a 3 to 5% increase per week uh so an example would be if you're going to do an exercise at 100 lb you can't necessarily just add 5 PBS every week that's going to catch up to you pretty quickly and so you may have to run some a smaller increment uh if you're doing like a lower body exercise

01:16:30 where you might have a couple of hundred pounds on the weight you can probably get away with adding five pounds because it's still a a low percentage of the total load so um that's roughly uh the guide that we want to get to for speed power and strength so that sounds incredibly simple and effective yet I have a number of questions sure first off if somebody is using the 3 to 5 approach does that mean they should not be doing any any other weight training of any kind in those workouts or at all no you you can certainly do that in

01:17:03 combination with anything else you would like especially if you think about speed and power those are very nonfatiguing and so if you could imagine uh you're going to go to the beach and you're going to take a 10 lb to 20 lb medicine ball with you and you're going to do you know four different exercises where you're throwing the medicine ball as high as you can in the air four times in a row taking a break and you do two or three HS that you do maybe three or four different types of throws um that's very

01:17:32 good for improving power extremely good but it's not very fatiguing so you could certainly finish that workout in 20 minutes and then run on and then do any number of other things so you could do um some high-intensity anaerobic capacity work you could do steady state stuff you could you could even do hypertrophy on top of that so there's a there's um two major categories of what we call periodization there's there's many many many of them but the two that have the most scientific literature are what's

01:17:58 called linear periodization and another is called undulating or often daily undulating periodization and I'm flagging these two again despite the fact there are many many many more because they represent two different concepts what you actually just touched upon so linear periodization is a hallmark by basically saying we're going to train one adaptation at a time so imagine going say six to eight weeks and you're only doing strength or you're only doing hypertrophy or endurance for that matter so in that particular case

01:18:27 you you would not do anything else in combination if you contrast that to undulating periodization you would actually be doing multiple different styles of training e with either within the same day or just different days so it could be Monday is power Wednesday is strength Friday is hypertrophy whatever or it could be a little bit of strength every single day a little bit of hypertrophy

every day a little bit of power every day and you would just change the amount of each that you do within the day to alter the emphasis all

01:18:56 right now if you look at the studies and there have been many uh rcts on this the result of both of these training programs is generally basically the same thing they are equally effective here's the major difference though one if your goal is very specific to one outcome you want to hedge towards specificity so if you're like hey I'm trying to maximize the amount of muscle I can build in the next 8 weeks then you don't really anything else else besides that is just distraction and potential interference does it really matter or

01:19:29 not doesn't matter but it's not helping anything else so linear periodization is is fundamental at providing focus and therefore the the adaptations tend to be um oftentimes larger in that specific area the downside is you now go six to 8 to 10 weeks of doing nothing else and so you are losing those other adaptations at a great at a faster rate uh and you can imagine doing something like speed work only again speed work by definition is non- fatiguing so when often times we think of speed work it's like oh I did

01:20:00 ladder drills and I did all these things and like I threw up at the end but that's not speed work you just did a different type of endurance training okay which is great and important so true speed work is very high rest very low fatigue and actually truly trying to reach a new level of speed or velocity so non- fatiguing if you did that exclusively for 10 weeks you would be pretty unfit by the end of it because you did you would also lose a decent amount of muscle mass not because there's an interference effect but

01:20:27 simply because of the fact you have not stimulated muscle growth for 8 to 10 weeks and so neither one of these is better than the other we're going to see this classically across all uh program design or periodization strategies is it's just a it's a given tick there are tons of different systems and and perhaps at the end we can talk about some of the more advanced periodization Styles um these ones are are both effective um you could do these with beginners you could do these with Advanced athletes you can do them any of

01:20:53 the spectrum but they're they're some of the the more well documented ones it's just a pro and con game right it's what are you willing to give up the way that you solve that problem is going back to that fitness assessment and your analysis and really truly understanding what your goal is uh is your goal to do a little bit of strength and a little about okay great maybe undulated periodization is an approach if your goal is really to maximize strength and maybe you can wait on putting some muscle mass on maybe linear

01:21:21 periodization is a better approach or another style of periodization that's optimal for strength gain so it's just simply about addressing your things one of the major problems folks have in addition to lacking Progressive overload is they don't have any foresight past the next day of the training right and so it's really important that you set off um blocks that are anywhere between six to 12 weeks long where you're going to have a specific plan ideally you have an idea for the whole year I actually

01:21:49 have like a structure I could walk you through uh for that but even if you don't have that really think about what you want the next 12 weeks and then maybe the next 12 weeks after that and that's going to give you a lot of guidance about what to do and what to focus on terrific what about warming up I was taught that one should do higher repetition movements with lighter weights in order to warm up and then one of the things that did make a big positive difference for me in terms of strength and hypertrophy training was to

01:22:17 do um a moderate repetition warm-up with a fairly lightweight but then to actually keep the number of warmup repetitions fairly low and work progressively toward the first so-called work set when you say three to five that's three to five work sets correct yep are you also going to tell me three to five warm-ups no are you also going to tell me it has to be done between 3:00 and 5:00 p.m. uh so in terms of friends in all seriousness what does a good warm-up look like and I realize this will vary

01:22:51 depending on how cool your training environment is time of day Etc but as a kind of umbrella for a good warmup okay what should people do the you've already sort of jumped the gun with my answer it it is honestly very dependent upon the person so some folks respond very well to a minimum more others I've had lots of actually um professional fighters I've worked with where the I actually have a major league baseball player right now he's one of the best P pitchers in the game probably the best

01:23:21 and the longer we warm up the better his numbers get we actually did a vertical jump test with him he's going to kill me cuz he got so mad uh I wanted to see how long it sort of took him to reach a peak vertical jump and most times this takes people something like five to 10 sort of reps um and I said take it up all the way to a maximum vertical jump and then what I want you to do is continue to Jumping until you have three consecutive jumps where you're down lower than 90% And so I what we're trying to look

01:23:49 at is sort of when is he going to break because in baseball he's going to throw like a 100 pitches or so and we're trying to figure out when is his Peak velocity on his fast as while going to drop and sort of Bas his conditioning on that so it's a different style of conditioning it's power endurance is really what it is um he called me in the middle of it I'm like oh done whatever and he's

just like no like how many of these am I supposed to do and I was like what are you talking about he's like I'm

01:24:10 on rep 130 or something and I was like what and I'm like what rep did you peek on he peaked on rep 70 something like that 69 I think technically because he's goofy um so he's a classic example I've worked him for many many years we have a ton of on him a ton of biological data a ton of um neuromuscular stuff like all kinds of stuff and it just the more he warms up an absurd amount of warm-up the better he gets and the better he gets in power production and the better he gets in speed and velocity so his warmup

01:24:39 prior to games is it's totally absurd uh and just the more volume we throw at him the better he does I have other folks you get past like two or three reps and fatigue starts to set in and now you're actually like reducing power production so there is a ton of variation that goes in that I can give you some guidelines though you need to differentiate if you're training for speed power strength or a pery here's why if we understand a little bit about what's causing the adaptation that's going to tell you what

01:25:07 you need to do or avoid for example volume is the primary driver in hypertrophy intensity is the primary driver in speed power and strength all right what so what that means is you need to preserve intensity for the first three you need to preserve volume and the second one at most so if your warmup is so ex extensive in the hypertrophy training that it compromises your training volume because of fatigue even if it compromises the last set of the last exercise then you're actually probably walking yourself backwards by

01:25:39 doing that extensive you would have been better off starting your first working set slightly suboptimal right because it's not really you're just trying to acove volume at that point strength and power is the opposite until you're moving very very fast or power you're not really causing the adaptation so there's no pony starting your working set until you're really basically at 100% so the warm-up should be as long as it takes you to get to where your Mobility is in the right spot like your joints feel good you feel fresh you feel

01:26:09 activated and you really feel Peak power anything before that is a warm up set in the sport of Olympic weightlifting um a lot of times the coaches will measure barbell velocity Travis Mash has done a fantastic job with this he's got a lot of data on what's called velocity based training Brian man at Missouri and and Miami tons of work here and generally those communities are not going to count any repetition as a working set until you exceed 70% of your one rep max where that's changed because of a lot of

01:26:40 people doing the velocity based stuff is now they're basing that simply on an achieved velocity and so really the warm-up is irrelevant they don't even P it's sort of just like do whatever you want and we're going to measure the barbell until you actually hit an outcome and now you're at where a working set um so different ways to think about it um depending on what you're training for that'll give you a little bit of a guideline if you're training for anything past hypertrophy then really and especially even

01:27:04 hypertrophy it just comes down to are you feeling um ready to work are you cold are you moving through the correct positions and if all those things are fine I don't care if you start a little bit early and save some gas the end of especially if you're a person like you who may be a bit more inclined to fatigue quickly uh relative to Trevor who's just has no response to fatigue whatsoever is it useful to do more warmup at the beginning of a workout say before the first exercise and then once one has achieved both local and systemic

01:27:38 warmup in air quotes um then perhaps on the second or third exercise fourth exercise Etc one or maybe even zero warm-ups yeah fair point we generally think about warm-ups in a couple of ways this is a really actually this is a very clever question you want to have some sort of General Global warm-up scheme U we tend to prefer Dynamic warm-ups so this is whole body movements rather than like sitting and stretching uh static stretching things like that so so something that involves momentum yeah momentum or movement right so this is

01:28:14 like um think about this in like old gym class it's like your high knees and and your butt kickers and just different things like that where you're moving in different planes um you're moving joints through tons of range of motion you're you're getting a lot of movement there so you're getting the local warmup you're also getting the the total systemic activation everything else is going on there so that is what we consider to be a general warmup five minutes is a very sufficient number

01:28:39 perhaps 10 if you're a slow goer achy and some things like that and you really got to get the ankle warmed up if you're doing lower body stuff really make sure that that's moving correctly the hips and knees will follow um upper body stuff really get the shoulder blades and the neck like making sure you're going there and the elbows will follow after that um so five to seven minutes of a general warmup a lot of the times like classic exercise science it will even just put you on a bike cycling for five

01:29:06 minutes I don't like that personally um Dynamic movement is more preferred if you really just move for 5 to seven minutes you'll be fine there now specificity within each movement it's very important that your first exercise of the day is generally the thing you've prioritize that's often times the most important you're going to do for it often times is also the most complex and the

most moving parts so it tends to be multi-joint it tends therefore you need to have um movement precision and skill

01:29:35 dialed right you don't typically start your workouts off with a forearm curl right like that's you don't need a tremendous amount of warm-up to get going on that you're going to start off with medicine ball throws or a snatch or some agility work you need to have the whole system going because multiple joints are moving position matters technique there's just a lot of skill requirement Etc so the individualized workout um or the specific workout for the specific movement for that very first one my

01:30:03 general rule of thumb is like whatever it takes to move perfect in that first exercise past that you don't necessarily need to do individualized warm-ups for your next movements unless it is a movement you're trying to learn or just even get a little bit better at like drop the load a little bit work on some uh acre some practice reps fantastic or it's another dissimilar complex movement so let's say your first exercise was a front squat and you got loaded for that and now you're going to move into a

01:30:33 pull-up but your mechanics aren't the best there and so you really need to change and do some maybe more specific activation warm-ups for that or something else or it's running or or something totally different so yeah you don't need to rewarm up for every single exercise as you go generally once you're good to go um the same muscles that you're going to use in the next exercise are warm same joints then you're good to go you talked about intent within the movement what about specific cadences for repetitions yeah I was taught that

01:31:07 one should lower the weight slowly the so-called Eccentric portion of the movement and then to try and explode the weight through the concentric phase and then also make sure that one is using full range of motion and perfect form yeah as it were now of course that is one tiny slice of the possible rep cadences yeah and ways to approach resistance training although I think it's a pretty good one yeah what are the general parameter sets that one needs to consider you could imagine lifting you know 4 seconds concentric

01:31:45 pause for one pause for two Eccentric I realize there's an infinite number of variations here yeah but is there a way to use rep Cadence repetition Cadence that is as a way to work through weak points um and to be strong in every position of the movement yeah a lovely question I think the the way I would like to answer this is maybe going back just a touch to get directly to that so I think if we walk through Power strength and hypertrophy and I hit you with the concepts that are specific to each one that's going to lay out your

01:32:21 answer because the most true answer there is it's depends on the goal um the answer for what is optimal for strength is diametrically opposed for potentially what's optimized for pretty the same exact thing can be said for momentum so we've classically heard things like this um you know don't bounce at the bottom um you're cheating right so if you're doing a lap pull down or something you know you don't you don't bounce and rebound you don't um you know you stop at the bottom slow down all these things are

01:32:51 thought to be truisms of strength conditioning but guess what those are all true isms assuming we're trying to grow muscle and that's that actually goes back to our conversation and in episode one about a lot of the things we think are just fundamental truths about strength training are just fundamental truths that came from the bodybuilding world and they're not wrong they're good ideas but there are other adaptations one needs to get from strength training that are not just maximizing muscle growth so what I will lay out to you is

01:33:19 a case for which you should bounce a case for when you should go fast as case for when you should be under control um all these things are are different variables we can modify and get different adaptations for it is there a way that you could lay out for us optimal repetition cadences for strength specifically versus hypertrophy specifically just to sort of bookend the conversation and then migrate toward the middle in terms of rep cadences that would satisfy the desire to have a bit of both we can get

01:33:52 pretty close yeah so when you're talking about strength versus hypertrophy remember strength is movement hypertrophy is muscle size that's that's the key to your answer here so when you're trying to get stronger what you're effectively trying to do is get better at producing a certain amount of force the movement okay now force is mass times acceleration so what's the mass in the bar multiplied by how well I can accelerate it intentionally going slower is only reducing acceleration right so it's hard to argue

01:34:30 that going slower is going to improve strength because you're simply reducing acceleration so you need to practice lifting heavier at a faster rate now does that mean if you're trying to get stronger there are no phases of your training in which you'll slow down or POS no of course not there are certain rules in different organizations where you have to the bottom of a like there there's all kinds of little things like there but in general we want to think about what are we trying to do here we're trying to get better at

01:35:02 moving a heavier mass at a faster rate of acceleration that is more force that is more strength hypertrophy is not that the goal here is not a functional outcome it is what is needed to cause the most amount of hypertrophy and when you get to hyper then your optimal Cadence is up to you you can do any combination in fact you could do it the same exact Cadence that you did your

strength training with and get the same adaptations as hyper if you modify the other variables appropriately or you could go slower or you could do

01:35:38 pauses or you could do a thing that is uh called triphasic training where you spend the first phase several weeks of your training where you do Eccentric only so you're just lowering the bar you're basically stopping you can then do the next phase of your training which is isometrics you're just holding at that bottom position and then the next phase you're training you're focusing on the concentric portion of it right triphasic 1 two 3 Eccentric isometric concentric so that's a fantastic way of developing

01:36:04 actually strength a little bit of hypertrophy but you're manipulating the variables in terms of how you execute the repetition range you can actually induce a lot of hypertrophy moving the weight fast as you mentioned even down slow into control now one thing one will never Advocate is moving any sort of weight or load uncontrolled the Assumption here what I'm saying go fast is you're always in control I never want you bouncing and crushing your sternum with a barbell Off Your Dust but you you can move at a lot of rates you can um

01:36:34 the isometric I mentioned because this is when things like body weight training come into play absolutely you can gain strength and even a little bit of hypertrophy especially in the upper body doing isometrics is much harder to do this with the lower body um you just you just you outrun that coverage really quickly you need load um but there's a lot of ways this is also probably why people have done things like gone to yoga only or Pilates or some of these things that are body weight based and

01:37:00 there's no external load and they've actually increased muscle size so I'm getting the picture there are a ton of options in terms of rep cadences however can we say that one should pick a given rep Cadence within an exercise rather than changing it from set to set within an exercise or that one should perhaps even pick a certain rep Cadence for an entire workout I'm suspecting that your answer is going to be it depends yeah it is but if you know I'm not going to use the if you had a gun to your head kind of situation but if you

01:37:31 had a gun to your head what would be the rep Cadence that you would prescribe yeah for strictly strength or as much strength with as little hypertrophy as possible and in picking that rep Cadence then it therefore has to thread throughout the entire yeah exercise bout so you're actually right you can because of that undulating periodization stuff I talked about you can actually do this in a lot always so you could do one exercise at the beginning where you have a set Cadence say a 311 is like a very

01:38:01 one so that's cons so that's Lifting for three pause for one lower for one uh generally the opposite okay so the first number is always the Eccentric generally okay soow lowering the the weight for a count of three pause for one it totally depends on the exercise like a deadlift starts concentric and finishes Eccentric but a bench press starts the opposite so it start to finish start to finish is better way to think about it yeah so in I'll clarify actually when we say 311 we're generally talking about almost

01:38:31 always the Eccentric is the slower portion regardless if it's the first or the last right so whether you're doing a bench press where the Eccentric is lowering the bar to your chest that's the first part of the movement one two three pause one one up which means accelerate as hard as you can on the way up that's what you describe right as opposed to say a row a row which is actually going to be starting off off concentric so you're going to be pulling that thing to your chest as fast as you can under control not slamming off your

01:38:59 chest holding for one second and then taking 3 seconds to lower it back on the rack or on the ground or whatever so the reason we do that is is somewhat intuitive but it is again to make sure you're not advancing a bar or an Implement onto your physical body at an extremely fast rate that that's very difficult to to deal with so a 311 is a very standard um strength protocol that is something you can just run with if if that's all you ever wanted to do it'd be absolutely fine lower the bar for a

01:39:27 count of three it actually ends up being approximately three because hardly anybody is counting off seconds precisely I mean it's I suppose it's doable but then pausing briefly yep and that brief is almost uh that pause is almost um unmeasurable it is simply are you under control before you transition from the Eccentric to concentric conent each it's just a safety thing so once you feel down you've reached complete range of motion you're ready to transition then just go you don't really need to go like thousand one and then go

01:39:56 up it's just making sure again we don't slam weights off of body parts and that final one in the 311 is the execution of the usually concentric portion of of the exercise yep as fast as you possibly can okay so that would be for the majority of the outcome being strength yep okay and of course we should acknowledge again there are a ton of variations that one could Implement there but that that would be a good starting place on the opposite side for somebody who's mainly interested in hypertrophy Y what would be the rep

01:40:29 Cadence that um if you had a gun to your head that you would prescribe I would probably do the exact same thing but I would like I would make the last number two so 3 one two you could also just keep 311 it is still very fine um even exploding on the Contra is still highly effective for training hypertrophy so if you wanted to keep it super simple and just make rep

Cadence not a variable that you play with because you have other ones to move that's great if you want to add a little bit of time to the

01:41:00 concentric phase fine it's not going to do it's not going to make enough of a difference for most people for you to really worry about I guess that's sort of the point I really want to make this is we're classically this is a classic example of we're deep into a method right if you long as you hit the concepts I talked about earlier whether you want to do 311 323 333 triphasic things this is just a method choice that doesn't mean they're irrelevant they are there are subtle changes within them it's just 80/20 rule right so 80% of the

01:41:31 benefit is going to be from the concept 20% is this small thing if you're super into this field or you actually want to work with a qualified certified coach or something there's lots of reasons to play with this if you're just on your own here and running this thing 311 is fine 312 totally fine anything like that um you really just want to make sure that in the strength side of the equation you're under control and you can add enough load to stimulate strength and not get hurt with an acute

01:42:02 trauma right on the hypertrophy side you're just wanting to load enough to where you can hit volume because you got to put a lot on there so if you want to go lighter if you want to go slower fine you if you go slower in your repetition so maybe even like a five SEC second Eccentric a 2cond pause a 3second rise that's great you can actually then stimulate the same amount of hypertrophy and either do it with less weight or do it with less repetitions so it's a variable you can play with if you're

01:42:30 like hey I don't have enough weights at my house or I only have a kettlebell or a dumbbell how am I going to stimulate hypertrophy your only option is really doing more reps well eventually that that train runs pretty shallow okay here's the thing you can play with maybe just add time under tension is what we're calling right um just you know do slower repetitions go longer ones and hold this so it's a variable that we use to individualize programs rather than something that you should really be

01:42:58 focused on as like a core aspect that's going to be driving whether or not your program works it's just a tool we can play with in the what if scenarios um I will use this stuff a lot when I'm traveling you can do a tremendous workout in your hotel room just doing like a 10-second Eccentric a 10-second hold a 10- Centric concentric yeah I've had some decent hotel room workouts they're not my preference but um by simply doing things like um 10c lowering uh handstand push-up against the door totally um obviously assisted for me I

01:43:32 don't I can't do a free hand stand push-up um I just don't have the skill or the strength or both um you can do some sort of configue dips between the beds or chairs and this kind of thing um elevated split squats are great to do in hotels put your back foot up on a on a bed and get a an amazing split squat workout done yeah glute Bridges lots of stuff you can do there yeah and with a jump rope if you ever heard someone jumping in the in the morning uh yeah um it may or may not have been me it could

01:43:58 be any number of things but I am known to skip R uh in hotel rooms um not to get overly detailed but I think there are going to be a number of people wondering about how to breathe during repetitions and how to breathe in between sets so I'd like to just briefly touch on this and this is something that I know we're going to return to again when we have our discussion about recovery yeah but is there a general rule of thumb for how to breathe during repetitions during work y for strength maybe even strength versus

01:44:32 hypertrophy in in a way that maximizes oxygen input to the system you know keeps you uh alert and conscious but that also protects the body by creating some rigidity in the system right because certainly being def with all your air exhaled the body is a very different beast in terms of stability than with the body full of air versus you know breathing during the repetition movement there's a a maneuver that has long been uh labeled the Vol Salva technique so what that really means is you're trying to use air to create

01:45:05 intraabdominal pressure and what you're really trying to do is create a cylinder around your spine the real issue you have to to play here is regulation of blood pressure and spinal stability now you should be able to breathe and Brace what I mean by that is you should be able to create total intraabdominal pressure regulate uh spine control while breathing it's just very hard for a lot of people to do it's it's a skill you should absolutely work on um you can actually you can do this and you can go

01:45:33 around like I do this trick in class and students can come and like push any part um of my entire abdomen is super tight and I can talk now it's going to be a little bit labored you can hear a little bit of a difference but you should be able to do that if you have to like hunch down and you can't even muster a breath and it takes that to create pressure you're not actually um you don't really understand the abdominal control necessary to create that stability so step number one is that's the goal now with the blood pressure

01:46:00 thing we have to be careful because a standard blood pressure uh ideally if we sat around right now is probably something like 120 over 80 systolic versus diastolic that's a normal number right high blood pressure is something over that well with an acute bout of exercise you can see that number reaches high as like 450 over 350 which effectively means you have total blood

occlusion right your blood pressure is so high blood is not moving anywhere and so in the middle of a very heavy set especially complex movements

01:46:27 especially when they're loaded on your body um this could be in overhead press or or squat variations anything like that blood pressure is going to be a problem and reason why that matters is that's what's going to make you pass out it's not the fact that you ran out of oxygen in 3 seconds it's the fact that blood pressure got so high you blacked out and so we want to have we're going to have to play this game of releasing a little bit of the pressure so we can actually get blood to move a little bit

01:46:49 making sure that we don't lose spinal stability um so we can finish our workout that's really the question you asked right how do I play this game of oh I have several hundred pounds on my back or my chest and I don't want to Exhale right so that I don't lose spinal stability but at the same time I don't want to pass out right which is a which is a problem so kind of a couple of rules of thumb if you're going to be doing something in which you can complete the entire exercise without a breath and it is of a maximal or close

01:47:18 to load that's probably your best strategy so in that particular case you'll see a lot of breathing techniques um where you're going to take a very large inhale ideally this is done through the abdomen not the shoulders so we shouldn't see clavicles Rising during this thing you'll see a common mistake of of the bars on their back and you see people do this like big inhale thing and all they do is Elevate their clavicles that's not necessarily going to increase pressure through the abdomen which is what you're looking for so you

01:47:42 want to be thinking about belly moving out in all four areas in front of you to your left and right and to your back that's that quadrant sort of idea of stabilizing your spine you can do that in independent of your clavicles moving like your shoulders don't need to rise for that you don't really need the oxygen for metabolic purposes you're just using the air for a brace that's really all you're after so you're trying to visualize your torso as more or less a cylinder yep and you're trying to fill

01:48:10 it with air the logic being that if I were to push down onto a say a full unopen can of soda yep water for all you sugar phobes out there soda water uh and then push as hard as I could it's going to be hard for me to crush that can but if the can were empty or if it were a little bit kinked in the middle correct then I could likely Crush that can yeah what you're really doing is you have your spinal Erectors in the back right and then a whole series of abdominal excises and you actually have some neural control sympathetic control of

01:48:43 Contracting those but the you don't have muscles on the inside that you can do so you're basically bringing in air and saying I'll use air to push from the inside out and I'll use muscles to push from the outside in to create this brace and I don't want overcompression with the muscles this is a like if you if you see people that have just enormous spinal Erectors sometimes that's an indicator of of actually a poor breathing or bracing strategy because they're using spinal rectors create all their

01:49:10 compression and not actually using the inside of enough it's not always the case but sort of like a thing to think about so overcompression through the spinal Erectors is not necessarily ideal um if you wanted the best scenario is a little bit of a brace a both so we use some air to push this side we use some musculature to press that way and then that that spine is just nicely held in position um again not in a position where I've locked down my diaphragm and I can't get any air out I should be able

01:49:36 to get that brace pattern um and then be able to speak in fact like I'm doing it right now and you'll see like a little bit of a if you're really paying attention to my voice you can hear a little bit of a subtle difference but I should be able to do this for quite a long time right like I I could take a maximum rep right here in this position whether I'm overhead pressing doing some sort of row like anything and feel fairly braced in in the entire quadrant this is very helpful I I'm going to work on it but can we say that

01:50:03 a an effective way to start off in terms of breathing during repetitions would be to take a gulp of air during the lowering phase the Eccentric phase and then to Exhale during the Y concentric exertion phase I asked that because that's what I've been doing for a while and it makes me feel safe I don't know if I am and it allows me to Exhale as I exert the the U hardest portion of the exercise yeah and perhaps I also borrowed that from martial arts where one tends most often is trained to Exhale on the on the strike yep if

01:50:38 you're going to be doing again the number of repetitions can be completed without a breath a lot of the times you're better off saving that exhalation until you complete wow but but for a reasonably heavy set of hack squats or even leg extensions and given that I already can't leg extension my body weight we establish maybe this is why um the idea of holding my breath for an entire compound set so again brings to mind um you know like where is my insurance card who's going to drive me to the hospital

01:51:11 this kind of thing um in all seriousness what if I want to breathe during the set yeah so I'll clarify I'm generally meaning if you're doing like a one rep max or something like that okay well certainly could hold my breath for a one repetition maximum that you know maybe like a double or something like that depending on what you're doing like maybe a triple a bench breath you can

probably do three and get away with it a squat it gets harder deadlift so it kind of depends on the exercise um you want

01:51:38 to take that be breath though prior to the Eccentric portion not during so let breathe in lock we're set and now start our movement pattern wherever it's going to be um exhaling on the concentric portion during it it is fine it's no problem um especially if you're not extremely heavy and what's your what are your thoughts on grunting and screaming yeah fine I don't care okay I don't tend to do that I'm occasionally known to squeal or whimper um but I do it person but I do it very quietly I think of you

01:52:07 and I think squeal whimper absolutely thanks um if you're going to be doing multiple repetitions uh what we actually do for the NFL combine is we teach them a very specific Excel strategy so there's one test that they do uh which is they bench press 225 pounds for as many reps as possible a lot of these people people will get 25 to 40 repetitions so we have a very specific breathing pattern it would be something like if we think that they're going to do around 25 reps say that's like our goal we might say okay do the first 10

01:52:34 without without a breath and then exhale reset and then do five breath and then you might do five breath three breath two breath and then one breath per rep until we can't get any more um so we'll have very specific strategies for them um so what I would say is is think about how many you're going to complete and and then breathe according uh to that and it tends to increase in frequency as the number gets closer to failure because you're going to want that that error a little bit but you just want to make sure that when you're

01:53:02 re when you're breathing back in you're in a safe spot so you don't want to be catching that like rebreath when the weight's on you you want to be in a locked out position or away from you when you're standing um so it tends to be like at the end of the exercise not in the middle of it um which is is going to be a recipe for problems if you take your breath then one of the reasons I'm so happy to have you here having this discussion is we can really get into the weeds but also hit a number of questions that I hear a lot Y

01:53:32 how does one contend with the first attempt at a lift not working out it too heavy something goes wrong hopefully not injury promoting wrong but something goes wrong do you count that do you reset the workout and then the counterpart to that question is what do you do if it's too easy when wrong wrong because you didn't put enough weight on the bar didn't pick up a heavy enough set of dumbbells do you abandon the set and and replace it with another and I guess this is really a question of how much margin for error

01:54:04 is there in volume yep when doing this 3x5 program sure uh two things that I'd like to start with number one is I talked about linear periodization and undulating periodization there's actually a new model newish model called Auto regulation which basically says you're going to go in today and depending on any number of biomarkers performance markers or your performance you will adjust your training based on how you're feeling that day and so 70% is that maybe for example not necessarily 70% of

01:54:34 your one repetition Max highest ever is 70% of what you can actually do that day and so it actually allows you to Auto regulate your training based on actually what's happening and so you don't have to have as much long-term planning in your program design um because it'll sort of figure itself out as you're going you can use velocity to determine this Auto regulation you can use actually it's like taking it up to close to a Max for the day and then basing all your percentages on that daily Max or a

01:55:02 lot of different ways so that is actually one very effective strategy and there's a lot of research coming out on auto regulation there's a lot of different ways to do it so that's one thing to say another thing to say is this three to five okay um it depends on if we're going for speed power or strength because while all those other variables are the same for three to five the core difference between whether that is a power workout or a strength workout is the load right so if you are at a moderate load say 30% of your one

01:55:33 repetition Max up to about 70% that's going to be a power-based adaptation assuming you're going with high intent can you sorry I I have to interrupt maybe just clarify what intent is yeah you're attempting to move the implement or go through the movement pattern as fast as you can great thank you if you're trying to go for strength and you're below 70% you're not really going to be improving strength because the total mass is not heavy enough and so really when we say strength we're assuming you're at at least generally 70% or

01:56:09 higher now if you're new to training totally different thing right but if you're moderately trained to highly trained you're going to be well north of 70% so anything below that we don't really count anyways um that's those are warm-up sets basically all right so one thing to actually give you some very specific numbers here and I don't have all of these memorized we can perhaps um provide a chart later or send out something to them but there's a chart that you can look up called a pilipin chart how do you spell that uh p r i l i

01:56:39 p i n i n pipin and there's actually been a a few studies on it it's it's a it's it's been old it's been around for a very long time it's sort of in the coaching realm and then a handful of studies out of New Zealand came out verifying and validating a lot of it but what it effectively does is say if strength is the goal and this comes from the powerlifting weightlifting sort of communities

optimizing for strength then how much time do I need to spend at each intensity range so 70% 80% 90% Etc because

01:57:10 specificity is going to say this if you want to get better neuromuscular guy at shooting a basketball the most important thing you could ever do is shoot a basketball under the exact circumstances that you're going to do it right specificity always wins if you want to get better at strength the most important thing you need to do is that exact movement at that load and in this case if you wanted to get better at you know bench press lifting at 100% of your max on a bench press is the most specific thing you could ever do the

01:57:41 more you can do that the faster you will increase your bench press Max however that's very hard to do without getting hurt it's also not addressing what I call your Defender so if the reason you can't bench press higher than whatever you're benching now it may not be your pure strength it may be any number of things like you don't have enough muscle or technique or these things okay great so specificity over here um variation on the other side and so we're playing this game we've talked about of of how do I

01:58:11 make sure that I can have enough specificity in my training without leading to uh overuse injury all how do I maximize or how do I reduce my chance of injury while getting enough speci specificity and so we have a classic Paradigm over here one actually training protocol you can look up is called the Bulgarian method and the bulgarians were un amazing um at the sport of Olympic weightlifting um probably in fact the the the patriarch of this entire thing recently passed away Ian IV uh neams L monog Glo pocket Hercules one of

01:58:45 the greatest weightlifters of all time came out of the system and they do a lot of things but one example in the Bulgarian system is you're going to do a one repetition maximum snatch you're going to take a little bit of a break you'll do a one repetition maximum cleaning jerk take a little bit of a break do a one repetition maximum front squat take a little bit of a break and you're going to repeat that two to three times a day every day that's specificity right those people get extraordinarily strong now

01:59:10 they don't do that all year round they don't do that with all their lifters but this is when we're trying to Peak for a major competition like the Olympics we are going so far into specificity and that was very counter to the Russian system with a which is much more of our classic periodization sort of approach okay specificity is is tremendous but in doing that the bulgarians just brutalize a lot of athletes right because it's very difficult to handle something like that and you can't really do that that

01:59:35 long without getting wrecked and there the goal is to win medals the goal is it's a totally different thing than longevity out of here right like we're trying to push the boundaries of or aesthetic changes unless someone has a naturally balanced Physique in general if people do one sort of movement I find that they tend to resemble the equipment that they did that movement with over time right that was a joke against kettle bells of course of course of course I got it so we know specificity is technically

02:00:02 optimal but it's not realistic not for that kind of a you know extreme situation so how do we balance these things well it turns out this pilipin chart gives you guidelines for how much time and by time I mean how many repetitions to stand um in each of these rep ranges so that you get kind of the best of this world you're going to find the same thing by way when we get into endurance training there's only so much training you can do at 95% of your heart rate before it starts becoming like quite detrimental you need to actually

02:00:30 spend a lot of time at those lower intensities so the prant chart walks you through how many sets and it gives you a range like like the I think that the bottom of it is like um how much time do you spend at like 60 to 70% every one at Max and it says like you know a minimum of this set to a maximum of this set but the ideal number of reps per set per week is like 18 and then it walks you through and so there's there's four CR IIA on it um I think it's 55 to 65% again how many reps there it's like 3 to

02:00:58 six reps per set um 18 to 30 reps total and I think the ideal rep range is like 24 something like that so it g takes you have 55 to 65 70 to 80 80 to 90 and the 90 plus percent what you'll see is the 90 plus perc number is more like 1 to two reps per set for a total of about seven total repetitions if you start cruising past that um other bad things start to creep up in there so that's a really effective chart what it really highlights though is even somebody who's trying to maximize strength you're going

02:01:33 to spend something like 35 or so perc of your training time between this like 55 to 65% range so you're asking early like well do I even count that one the the answer is yeah you know in that range if it's below 55 60% you probably don't count it now again some coaches don't count it unless it's even above 70 fine it's not a major distinction but you're going to spend the bulk of your time you know accumulating some some technique basically and skill and tissue tolerance very important um The Next Step Up is

02:02:04 like 28% I think is is sort of the cut off of how much time you spend um between 70 and 80% of re one or Max and then it jumps down to like 23% and then all the way to to 70% so you can walk yourself through that and that gives you an extremely good guideline and you'll notice all of these are still in three range it's just really you're manipulating it by total sets or total exercises so

that can give you some structure to play with we will provide a link to the pipin Chart yeah in the show note

02:02:35 captions training to failure when the goal is strength yeah should one do it should one avoid it or does it depend well yeah it always depends um the way that I'll generally say it is because of what we just outlined in the Brin chart you don't have to go to failure to see strength gains especially early or even moderate and I'm talking maybe five plus years in your lifting career would you um call beginner zero to five years of training intermediate five to 20 years of training yeah something like that and

02:03:07 then Advanced would be people that really put the time and energy into fine-tuning their program the vast majority of people who think they're Advanced are really what we would call intermediate in all domains of life Fair even as a scientist it's quite rare to reach that number of advance so um I actually don't have any problem going to failure quite often um I'm also fine with people who don't want to go all the way there you can get most of what you need getting what we call technical failure so this

02:03:33 is like okay that was really challenging uh boy you started to have some breakdowns of technique we're going to call that good The Only Exception here I I want to point out is people who are either novice or beginners they really have no concept of what 100% means and so I think it's actually very fruitful to take them to 100% just to give them a guideline of where it's at now of course do this on exercises that they are comfortable with or close and then you may maybe maybe this is on a machine maybe this is um single joint

02:04:09 movements or whatever it takes for them to have confidence but I actually I don't think you should be scared of these they're not really um that much more dangerous than anything else there's I mean think about it if you're going to do a front squat or any exercise and and your one rep max is 200 lb is it really that much more dangerous to do one try at 205 lb than it is to do five tries at 190 pounds like is it really that much more no like it's not so you can do like we talked about in the the first episode you can do a a

02:04:39 repetition Max estimate where you get to like 85 to 95% of where you think you are and then instead of adding load you just do as many reps as you can Google that number and then it'll tell you the conversion and estimate of what your one RX is that's fine but I also I have absolutely no issue uh in fact I generally encourage it to take people up to that level um certainly not day one or or anywhere close to that but at some point let's see what you actually got I'm just I'm just going to cut it off

02:05:05 early what I'm going to consider to be one at Max um anything more than a minor technical breakdown is for that crew we're going to stop and call that good and ideally with a spotter especially um you know bench pressing don't bench press alone in your basement kind of thing a few people die each year from bench pressing alone in their basement or use dumbbells if you're going to do that hard harder to die using dumbbells I suppose you could um drop them on your head or something but not get stuck under them um exercise

02:05:34 selection and frequency of exercise implementation across the week so I can imagine with this 3x5 routine done three to five times per week you could imagine changing up the exercises every workout MH although considering that most of these 3x5 routines are going to be done with compound movements generally that sooner or later one runs out of movements if the goal is to hit major all the major muscle groups yeah however Let me Give an example and ask if it's okay to for instance do the 3x5 routine where one of

02:06:12 the exercises for back is say a bent over row uh you do that on Monday Wednesday and Friday okay you know I can imagine one could do that and still recover and improve over time but 5 days a week bend over Rose 5 days a week is that okay I mean can one still progress um and there I could imagine it's a strong answer of Depends because some people recover more slowly and others I'm very comfortable doing hitting muscle groups once directly per week and once indirectly that's worked for me far better than two

02:06:47 or three times per week you know I get you know looks of sympathy when when I say this but it's actually is just how my physiology Works um kind of yeah well and maybe I'm not optimizing a number of different features but the point being that some people really do seem to be able to train a muscle every day and still make progress other people seem to have trouble when they train a muscle every day so how does one establish exercise selection when the goal is to make progress um and this brings up

02:07:16 something very important and we're going to have an whole episode about this but local versus systemic recovery y that you know is the whole nervous system becoming fatigued and is the muscle group and the related muscular skeletal systems becoming fatigued we're going to go back to thinking about when you make these comments about it takes you three to five days and you've got better results in there the assumption that you're probably running under is your training style is more reflecting that recovery time than it is

02:07:48 your physiology it's not you it's you're training so if you look at again all the Olympic weightlifters that are competing they're going to be squatting or some variation of squatting every day that's going to happen like a lot of the times they're training multiple times a day and they will be doing some basically barbell full squat multiple times a day every day six days a week you know

something like that they're the best in the world at getting powerful they're tremendously good at getting strong you can do it right it comes down

02:08:20 um to what does your volume look like what type of movements are you doing um what rep range uh what overall volume are you hitting and how are you doing it if you look at athletes they train their legs every day when they're running around they're doing Speed and Agility training every single day they don't need you know three days to recover can you imagine a basketball player trying to ask for like three days to recover between practice right well to be fair as you as you chuckle at me I'm doing other things on

02:08:47 the intervening days yeah so I'll train a muscle group like legs and then I'll give it 4 days before I do an indirect yeah um uh what I call an indirect exercise for legs which for me would be sprinting then it get two days and then I'm training them again but nonetheless an athlete has to do that every day right right so the ABS the answer is you absolutely can train any of these muscles every single day it really comes down to volume right and it comes down to movement type um and how are you

02:09:17 getting so with in the case of of weightlifters and and athletes what we tend to see happen is there's not a um there's two things there is a long period of conditioning and I don't mean endurance what I mean is is tissue tolerance and conditioning so they're not going to start off their career at that pace right their career might start start off at five days a week but maybe every other of those days is a PVC pipe only and you're just training the movement patterns you're working on technique Etc and then eventually maybe

02:09:45 after 6 months or a year those PVC pipe days turn into barbell only days and so now you went from you know a pound to 45 pounds and then eventually as your years go on that that ratchets up so it depends on the style in general speed and power stuff is so light it almost require because it's non- fatiguing it requires almost no no recovery so if you were truly doing say like um you know your when you say it's funny because when you say I do legs on Mondays you don't even realize it but an athlete does legs

02:10:16 every day right but you're saying legs and what you're really saying is I do hypertrophy legs Monday pretty much that I don't want to get into what I do specifically because it's less important than what other people choose to implement but the repetition ranges anywhere from four to 12 correct soy you're smack dead in the peak sorus longest recovery range volume is relatively low intensity is very very high workouts are very very short so if you were to switch that and you were to stay under four repetitions higher

02:10:44 quality uh higher rest in between them I would be willing to bet a large amount of money that you'd be fine the next day certainly 40 hours and if you were to actually go way lower and keep you know 3 to five and keep it very very light and train for Speed you would have absolutely no issue the next day so it really comes down to a function of training you're right in that hypertrophy Zone which is something that you probably need 48 hours at minimum to recover from because What You Won't See

02:11:11 are bodybuilders training the same muscle group on multiple days like very often at most it would be indirect but generally they're not going to do that every single day for the same reason so you're training in that style that's what it's going to take to recover if you trained in a different style then it wouldn't take that long to recover so for the person starting out would you recommend they pick three to five exercises and stick with those so that they can get their skill and movement and positioning and breathing all that

02:11:39 really dialed in and then start to experiment by varying one or two of those exercises over time that's great if you look at the conjugate model so these are the strongest powerlifters as a collective group that ever existed what they're very good at is they keep almost the exact same weekly structure but they make a very small change in exercise variation so for example say Wednesday is bench day right they're going to always bench on Wednesdays but maybe this week they're going to do close grip bench and

02:12:07 then maybe next week it's going to be maybe a special type of barbell and then maybe the week after that it's um you know maybe they'll change the range of motion a little bit so it's actually the exact same exercise where they're making a very small variation and that change alone allows them to do enough specificity but also gives them enough variation to where it's not the exact same stimuli in the exact same spot over and over and over and that's what allows that group plus lots of other assistants

02:12:34 but it's what allows that group to train very very heavy very consistently and not have to worry about too much planning for periodization and other stuff like that they get their back off by making small variations and exercise I will say a major mistake folks do make is they change your exercises entirely way too often um if I were to have to pick one or the other I would say don't change anything on your exercises for 6 weeks probably realistic maybe even 10 to 12 weeks and then you can make some

02:13:03 changes um you should not be changing every single week um the general you're just you're not going to see progress it's going to be very difficult to do that so um it's going to take you three weeks generally to figure out the groove of the exercise to figure out how well you can load it what's too much to where you woke up unbelievably sore that was a train wreck um how much do

I load it at how what position how long is this going to take it's going to take you three or so weeks and then you can really start

02:13:26 pushing there so changing it before that or in that time frame is is you're not going to be able to progressively overload because you're just not going to know exactly where you're at on all the exercises so it's very important to create standardization within them and then see some progress in a movement or a muscle Group whatever you're going for and then make some changes so before we dive into our discussion about hypertrophy can we just get a brief recap of the general parameters for an excellent power and strength training

02:13:56 program okay let me hit you with these rapid fire and then you can maybe come and ask questions along that remember those modifiable variables okay so let's go through them in order and then what they mean specifically for power versus strength so modifiable variable number one is called choice so which exercises do I select for strength in general for power or speed or strength we want to select compound movements you don't often see people doing maximum strength work for like a tricep Kickback right

02:14:23 it's typically multiple joint movements and typically complex um movements in selecting these compound movements we generally want to actually think about exercise selection of movements rather than muscle groups so this is an important distinction because we'll see this is a different answer when we get hypertrophy what I mean by that is when we think about again strength training we tend to think about bodybuilding Concepts we go to the gym and we do things like I got to make sure I get my chest today and I got to make

02:14:50 sure I get my hamstring strs and now you're selecting exercises based on a muscle you want to work for strength development and power we want to think about movements rather than individual muscle groups so there should be like things like I need to train explosive hip extension which is like a a vertical jump or something like that I I want to train pushing or pulling movements or I want to attain rot I want to train rotation which is a whole area we haven't gotten into which is very important for overall health and

02:15:18 wellness longevity so we want to select big movements by the muscle the movement patterns that we want to introduce and we just want to select a reasonable balance between these I don't care what the exact ratio is you just don't want to go an entire six months without doing anything in this rotational area or an entire you know 8 to 10 weeks without doing something um uh that's a lower body hinge right so any number of examples there so just think about the rough movement patterns upper and lower push

02:15:50 and pull and then some sort of rotation that puts you in a pretty good spot if you're using 3x five method and you're going to pick as little as three exercises just pick one from each one of those group pick a rotation pick a push and pick a pull I can easily think of a push and a pull um so for example um bench press or shoulder press sure um row or chin for pull and then squat or deadlift for hinge yep what would be a good example of a quality rotational movement y so anytime um you can can use

02:16:21 a cable machine like at the gym and you can do it's kind of hard to describe this exercise but basically you're going to stand facing the cable and you're going to pull it toward yourself and then rotate like you're pivoting like you're um either swinging a golf club or hitting a baseball bat so you're facing One Direction I'm facing you right now I'm pulling the cable towards myself and then I'm going to spin do a 180 degree pivot and face exactly away from you when I finish and then return it back to

02:16:47 that same spot so that's a rotation great we will provide a link to an example of that that you consider a quity example a medicine ball throw any number of things like this are a great rotational exercise all right so we select our exercises based on that we generally then the ca because of that as the case we don't worry about things like Ecentric versus concentric because you're dly doing a whole body athletic movement right which the Ecentric concentric portion is going to be folded into that you really can't separate them

02:17:17 out all right so that's exercise Choice our first variable the next one is exercise order so because that everything driving power and strength is quality based you want to do these at the beginning of your workout you would not want to do anything fatiguing before this so no cardiovascular training no other uh repetition to failure stuff if you do those before and now you're slower all you've done is practice getting slower and and so these need to be done when you're fresh you also need to do them when you're very fresh

02:17:49 because they are the most neurologically demanding they're complicated they tend to have multiple steps and they're often in multiple planes and coordination is a difficult thing and if you're trying to do all that at maximum speed your nervous system needs to be tremendously fresh and so any amount of fatigue here is only going to compromise results um to kind of recap that uh one of the major mistakes when training for strength and especially power is people worry way too much about fatigue those

02:18:12 things should not be part of the equation in fact if they are that's a very good sign you're not doing this correctly right these are non- fatiguing movements especially speed and power so Choice order is next um the next one after that is volume and we sort of hit volume and intensity which is the other one um we we talked about that the volume is basically identical between power

and strength um the the general number we're going to look at here is something like three to 20 sets total per workout per workout um but that

02:18:45 would be like 20 would be a little bit of a special case three to five is what I told you earlier right I'm just saying like sometimes you can actually go quite higher in cases but that's the general range and once somebody finishes the 3x5 workout for power or strength if they decide they want to throw in some calf raises and curls and totally a forearm work or a little bit of uh joggy on the treadmill or something that's okay absolutely that there is you have very little risk of interference for things like speed and

02:19:18 power strength you have a little a little bit of a risk only because now you're introducing fatigue which if you're really pushing strength that might compromise your recovery ah I could imagine doing the three to five routine for strength or for power and then somebody finishing up with um 10 or 15 minutes of hypert try arm workor and then being very seriously compromised if they try and come in the next day or even the next day correct and do those big compound movements for Speed and power that's right not just because

02:19:48 they're sore but the muscles may actually still be damaged and I know later we're going to talk about the um somewhat tenuous relationship between soreness and Recovery yeah yep so that that's a that's a really nice uh heuristic to pay attention to is you can but just be careful Energy starts to matter at that point um if you're really truly trying to maximize strength you would do nothing at all outside of that training um if you're just like I kind of want to get stronger and some other things and you're willing to lose

02:20:17 strength you know 5% of your strength gains then you're you're to fine um the same can be said by the way for super setting so super setting is an idea that says like wait a minute you're telling me dude I got to take five minutes in between each set well that's not so much a problem nowadays with phone with um smartphones because people are filling their interet intervals with social media and texting correct you you don't really have to go that long in fact there was actually a study that came out

02:20:45 in the last month that showed you know like really 2 minutes is probably sufficient for most people having said that if you really are trying to push maximum strength adaptations like 3 to five is very very reasonable um you're those training sessions are long because you have to take you're spending more time not doing anything than you aren't doing something but you're trying to maximize quality so that's just sort of like part and parcel um if you're not super worried about it you can actually

02:21:10 do super setting which is let's imagine again you're going to do some some lunges and while your legs are resting doing their three to five minutes you can go over and do an upper body row or pull and when your upper body's resting you're going back to legs so that really Cuts your time in half is it ideal no we actually ran a study uh maybe 10 years ago in our lab and we looked at that specifically and we did see a reduction in strength performance in the super setting group relative to the group who

02:21:36 did not superet the question then it becomes like is it enough for you to care so if you were if I were to say hey I can cut an hour off of your workout time but you will lose 5% of your strength gain almost everyone would take that exchange with the exception of people who are getting close to competition or really trying to set a new lifetime PR or something then you might say no I don't want any interference there that last little margin is what I care about give me the extra rest great so it's not a

02:22:03 does it work does it not work it's always a what are you willing to give up uh versus get the practicalities of super setting or staggering Push Pull Push Pull uh in my mind are real because you have to take over large segments of the gym which oftentimes leads to a situation where your rest times are too long or highly variable because people are working in or you can't finish your set because now someone jumped into the machine totally screw you lose three to five of your friends because it's obnoxious when you're

02:22:31 taking over all the equipment but in all seriousness I think um it's wonderful if you have the space and the and the format to do it but at least in my experience and observation um these people know who they are uh it's not practical to do on a regular basis if you train in an open commercial gym yeah tough to pull off so um we've covered Choice order volume and intensity to a sufficient level the last one is frequency and we've already sort of indirectly talked about that where frequency can be as high as you'd like

02:23:02 in this area it really depends on your recovery if you're really truly pushing maximum strength you probably do need a few days to recover although that's dependent upon you but speed and power can be done multiple times a day almost every day basically um the one exception would be maximum sprinting speed you need to be careful there for things like hamstring uh injury especially if you're pretty fast so you want to be a little bit cautious of that but if you're doing easier movements um like medicine ball

02:23:28 throws or kettle bell swings or something you could do those quite often as long as the volume is is staying pretty low last little piece here is progression how do I progress over time so I mentioned this earlier but just wanted to fill this Gap right back in before we head over to hypertree which is 3 to 5% increase per week of intensity in general um and you can do upwards of

about 5% increase in volume per week over time and I generally recommend running that for uh at longest 8 weeks but probably most realistically

02:23:58 you want to go about five weeks or so and then have some sort of a D Lo or back off week if you do that you're you're generally going to be a pretty good spot um so those are like the Core Concepts now there's a whole bunch of fun methods you can play with within all these categories and and I I would like to actually cover just a couple of them um if we've got a little more space for that sure I'd love to hear about those I'd like to also just cue up one which is while I joked about people texting

02:24:28 and doing social media between sets and I that's not a joke I well I confess I stopped bringing my phone into the gym yeah um because of the urge to you know take my mind off of the workout and I just started enjoying my workouts a lot more yeah and the workouts go far better that way and they're they're just much more efficient it for me I I realize that some people their careers take place in the gym so for I don't um look down upon anyone using their phone at the gym but that really tends to help um

02:24:57 me but I do wonder whether not there's an optimal Behavior or mindset in between sets M um I've heard before that pacing around can actually help diffuse some of the lactate and other metabolic uh byproducts of work and exertion yeah that can lead to better performance I've also heard that um you know shaking the muscles out I mean there's all sorts of Jim lore um about this but maybe there's also some decent science I'm just curious uh if you have any specific recommendations that people could play

02:25:30 with or try yep so for Speed and power um you want to walk this balance of stiff but fresh and so if you were to literally finish a repetition sit on a bench for five minutes you would stand up after that fairly stiff and you wouldn't feel sort of smooth this is all SC this is all non-science this is all practical application right anic data anic data there you go strength is a little bit different but it's the same concept you're walking that line um in general a lot of the times if you see

02:26:00 powerlifters and weightlifters in between sets they're going to sit down and not move for hypertrophy can be a little bit different because you're getting towards fatigue and so the factors you mentioned like clearing lactate well first of all lactate is not actually causing fatigue that's that's a giant myth that we which is why I need it up no I'm just kidding um but in the case of again speed and power you're not going to fatigue so fatigue management is not really issue you want to make sure that you're getting complete

02:26:22 neurological recovery which is a little bit slower than muscle energetically you're not out of any gas whatsoever right um You are not a lack of fuel you know doing three repetitions of a vertical jump Y no close plenty of glycogen totally what about stretching between sets yeah you probably don't want to do that either um there are very clear examples of pre-exercise stretching static stretching being quite detrimental for maximum power production the same thing for Speed uh and strength and that's been shown actually a number

02:26:52 of times in a number of Laboratories which is like a a classic Hallmark any scientist looks for of like really jumping on board with an idea if it's shown not only multiple times but in multiple Laboratories from multiple scientists and they're all seeing the same thing you start to get a lot of confidence that that's a real finding and that's been shown um we've done that in our Center for sport performance not myself but one of my colleagues has done a lot of stretching research and he's seen that a lot on everything from

02:27:15 vertical jump um to ISO kinetic dynamometers and and force velocity curves and there's um we we've seen this in sprinting we've seen this in speed we've seen this in loaded stuff so um you don't want to spend a ton of time stretching statically stretching a muscle prior if you do that and you have to do that say for example you finish that you're just like feeling really tight yeah go ahead like you need to get in the right position especially for most people where are you willing to sacrifice 10% of power to make sure you

02:27:41 don't get hurt yes that answer is almost always yes outside of some very specific athlete scenarios so if you're not in the right position I actually remember having this conversation with Kelly Kelly started a long time ago was just like yeah fine I'll lose 5% that means I'm not going to get in a bad position and hurt my back I and I totally agree so if you got to open up a hip or an ankle or something to get there get in the right position number one we'll live with the 5% reduction in power and

02:28:08 if you do just reactivate so before you go do your working set go do something fast again a vertical jump a short Sprint an acceleration and sort of get that system cleared back up um if you didn't stretch it for long enough and you didn't hold it for long enough you should be able to be just fine so um when it comes to hypertrophy yeah you can really stretch all you want because we're not it's not driven by intensity or outcome it's being driven by an insult into the tissue and so if you're

02:28:34 pre- fatigued for hypertrophy it doesn't matter if you're pre-stretched that doesn't matter we're not going for quality of outcome we're going for quality of internal signal which is not going to be um Changed by your Force output so it doesn't really matter you mentioned a few other things that one might consider in light of uh the list that you provided of choice order volume

frequency and progression right so starting off with power uh I just wanted to hand the the listeners here with a whole bunch of different

02:29:03 methods to go play with right so as long as you hit those Concepts the repetition range for power 30 to 70% of your one repetition Max depending on the exercise and your training status um you're going to get the power as long as you're attempting to go fast this going to be great a lot of things you can try ply metric are a great example um of things that are effective for um for power development we we've mentioned medicine ball throws uh short Sprints you can even do Sprints uh on like an airbike

02:29:34 which is a great super safe activity you can do them from Like a Rolling start where you kind of like get going a little bit and then you explode for 5 seconds to see how fast you can get or a dead start like both of those are very very acceptable um weightlifting movement so snatches and cleaning jerks are tremendously effective in fact they are pound-for-pound by far the most effective uh exercise choice for power development like without question um so those are good ones clapping push-ups speed squats these are a whole host of

02:30:02 different things that you can do for Speed and power development I'm depending on your kettle bell swings another great one um all these can be done depending on your preference exercise availability what's at your gym or not gym any of those things if somebody is more focused on strength as opposed to power what are the additional variables they should consider again within the context of this overarching theme of choice order volume frequency and progression absolutely it's almost identical with a couple of small

02:30:33 exceptions number one you probably can't do as many working sets per week for strength because now you're introducing a heavier load and that's going to represent some sort of fatigue um load on the tissue all those things so you could probably get away with doing 20 sets of two of a vertical jump four or five times a week you probably couldn't do that at a 90% on squat right so the total amount of sets and the total amount of weekly load you can get to just needs to be lower and then the intensity right so we

02:31:03 talked about that needs to be generally higher than 70% with you know some portion of that being working sets and some portion of that really truly being at 90% plus everything else is is pretty identical you still want to emphasize maximum speed despite the fact you may actually not be moving faster because you've introduced load you still need to be attempting that but you're going to be picking complex exercises you're generally going to be hedging more towards barbells in machines so this is

02:31:29 a case where um body weight training can be effective again particularly for the upper body but at some point you're really going to have to move past that because there's just a certain amount of load you can't put on the lower body with just your body weight you get limited by how much you weigh or I mean there's a couple of things you can do but you're going to run out past that pretty quickly and so in when it comes to strength they tend to be less athletic movements because um you know we have to have a barbell on us we have

02:31:58 to have a we have to be on a machine or something like that and so that's a subtle difference in exercise choice we need to also be careful about the Eccentric portion and things like that we don't have as much risk in like a speed or power one so um some of the different things you can play with there we've talked about doing things like pushes and pulls I also love carries so a farmer's carry uh pushing a sled dragging a sled all kinds of things a Yol walk all kinds of of carry modalities that are very very effective

02:32:28 for strength um there's Eccentric overload training which we really haven't gotten into but it's a really Advanced technique where you can actually load at greater than 100% of your one repetition Max but you're only going to do the Eccentric portion of it um so physiologically you are much stronger eccentrically than you are concentrically um for a variety of of muscle tissue reasons actually and so imagine if you can do a bench press at 200 lb and what you might actually do is load it to 220 and you would have a

02:32:56 spotter and and maybe even use it in a rack and you would lower it Down Under Control all the way to the bottom and then stop your friends would lift it back up the top and you just practice that Eccentric portion you would actually be able to lower say 220 pounds effectively despite the fact that you wouldn't have been able to lift it back up um you don't need to start there but that is a very effective method for incre in fact argue one of my um one of my doctors stud right now is is doing a project on this at

02:33:22 USC and he uh like he's focusing directly on this and it's it's quite clear this oftentimes more effective at strength development than anything else because you can actually just like in the speed example where you want to actually practice moving faster so instead of practicing at 100% of your one or maxtra strength you actually practice at higher than that to get better at it um so that's that's another um much more advanced tool please don't let me get sued by saying all that like folks be careful

02:33:50 make sure you're doing the proper exercise and you're positioning and and like caveat caveat okay um but outside of that it can be it's it's totally fine and safe yeah with it when people get injured they can't train you can't train you don't progress you you lose progress so uh certainly that that's worth highlighting so two more um little more advanced techniques that that

I want to throw out there and one of them is called cluster sets so cluster sets are there's a bunch of ways to do it but imagine taking a mini break

02:34:17 in between every single repetition so say you're going to do five repetitions in a row what you're actually going to do is do one repetition set it down pause for 5 to 10 seconds and then do the next one pause do the next one pause pause pause pause so you can imagine doing like a squat and you're going to go down explode up you're going to stand there you're going to Rack it out you're going to kind of like shake back out catch your breath walk back in do another one rack it out and you're

02:34:46 going to repeat that until you've executed your three or four or five repetitions and then you take your 3 to 5 minute break before your next set that is an incredibly effective way for both strength power and actually even hypertrophy because you can keep the quality the force output the power output very very very high because you're getting these little Min breaks and you're not getting fatigue setting in by the time you hit your say third or fourth or fifth repetition in that set um after repetition one you start to see

02:35:16 very small subtle reductions in power up but because you start to see a little bit fatigue you you take those 5 to 10 seconds off even up to 20 seconds you can actually do it um you don't see any drop and and force output over the course of the five and so what you really have done is you've gotten five in this example first repetitions which is the way we kind of say it right so all five of those had the same quality as rep number one which is again as we're talking that's the driver and strength and so that's the one we want

02:35:44 to preserve so um it takes a little bit longer um for some exercises it's not very good um it's great for like a deadlift because you set it back down shake it back out regrip hard to do with the bench you got to Rack it back in then rerack it back out that's it's like kind of a pain in the ass um so there's some exercises it doesn't work well with and some that it does but cluster sets and a lot of research on those um very effective would you recommend if somebody's doing cluster sets that they

02:36:11 do them for every session within that week or just this is an occasional thing you could do it this could be your training strategy yeah absolutely so you can really take it that serious um in fact like if you look at again the weightlifters they will do cluster sets by default not even trying so say they'll do like a clean and then they'll drop the weight back out they're supposed to be doing say a set of three but almost always they're going to like Shake It Out regrip and then pull it again and sometimes their set of three

02:36:34 takes like a minute and then like you hear it's funny because it's like like I set a tri a triple PR you're like no you did three singles like what's the difference between doing three singles and a set of three when you took a minute between each rep um I love that community so yeah I mean it give be your strategy like it could be like hey for this five we block this is all my training especially for your compound movements if you're going to go to start doing some of the smaller movements maybe you give up on that um it could

02:37:00 also just be something you do for your one primary exercise for the day so do that thing that is the most important first and just do it for that one and then the rest of them you can kind of ditch it if you need to save a little bit of that time um it can also be something you do by feel so you know you're your two reps in and you go God like I'm not feeling like poppy here like rack it catch my breath for a quick second and do it so it doesn't happen have to be ultra planned um I guess what I'm doing is is I'm giving you an excuse

02:37:25 to make sure you're super fresh for every rep it matters the last one I want to talk about here is what's called Dynamic variable resistance so Dynamic variable resistance is uh fixing the problem we have with What's called the human strength curve so theory of constraints again you are only as strong as you are in your weakest point of the movement so depending on the the movement you do this happens at a different range of motion well the deadlift is the easiest example um it's also because we've done like research in

02:37:57 my lab using this stuff on the deadlift so I can speak to it very directly when you go to pull it off the ground some people are going to fail right at the bottom meaning they won't get the weight off the ground at all some people will fail just below the knees that's like kind of like the hardest transition period and then some people will fa right at the top just before they can lock out okay great so what that means is at some point of that lift you're going to only be limited by your strength in the weakest area all right

02:38:26 so if you have a constant load on the bar in those other two parts of the range of motion where you are not the weakest they're never truly being tested for their maximum strength because they're always being limited by the previous one this is the same argument that we would get into if people ask about should what what do you think about using straps right um You strapping your hand to a bar for deadlift things like that there's pros and cons here there are times when you want to use a strap and

02:38:52 there are times when it's a bad idea so what dynamic variable resistance is is either using things like a heavy band or a or chains on the bar if you've ever seen people do that um so in my lab we actually have a force plate on the ground and then we have um built-in basically hooks uh in the front and the back so we can actually set a a barbell on top of the force plate where you

stand on it and then run bands from the back to the front running over top of the weights and so when you stand up as

02:39:18 you're going up vertically the band are getting Tighter and Tighter and pulling the weight towards the ground so the weight is getting heavier and heavier as you stand up so as you start to gain mechanical advantage in your positioning you start to increase load because the bands are getting Tighter and Tighter and Tighter so this allows you to train that full part of the strength curve and to challenge um your stronger areas with heavier weight and your weaker areas with lower weight um you can do the same

02:39:45 thing with a bench press you can do it with a squat and any other exercise variation and dynamic variable resistance um is incredibly effective for a number of things um you're going to give up a little bit um because the total load you can put on the barbell is lower because you're going to be adding you know in large cases several hundred pounds of band tension and so it pros and cons it's always a game it changes the curve but it's it's a it's a very good technique um that that people it's

02:40:16 fairly easy to implement it's fun and in fact if you try this on a bench or a squat you're going to be the first time you give it a go you're like oh my God cuz the bands are pulling you all over the place um so you have to get very stable very quick um been shown a number of times a handful of studies out of many Laboratories to be a very effective training technique a little bit more advanced but I wanted to throw that in there for the folks that are maybe just tired of sort of doing the same barbells

02:40:39 and dumbbells and machines and you want to try something different a very effective technique sounds like fun yeah it's great with your permission I'm going to read back my summary list of training for power and training for strength according to your description and you can tell me where I'm right and where I'm wrong yeah I'm going to pick three to five exercises and these should be compound exercises so multi-joint movements I'm going to perform those exercises for three to five repetitions each I'm going to do three to five

02:41:09 movements total per workout and I'm going to rest three to five minutes between STS okay if I'm training for power the weight load on the work set so not the warm-up sets but the work sets are going to fall somewhere in the range of 30 to 70% of my one repetition maximum yep and the larger the movement the higher that number goes so on a squat you're okay getting 50 or 60% on a bench you would not want to go that high uh you would want to stay close to that 30 to 40% range so the way you scale that up and

02:41:42 down is dependent upon um the difficulty of the movement great if training for strength I'm going to have my work sets be 70% or more of my one repetition maximum yep and the only thing to add there is in the case of actually all of them um it's okay to go less than three reps per set so a single or a double you know one or two rep time is also fantastic so uh we use three to five as the concept but less is okay going more than that is generally not a good idea so less is okay more is generally not

02:42:19 okay and then you listed off a number of really valuable I don't even want to call them fine points but important points to keep in mind within each in both of these programs one that really stands out in my mind is this idea of if I perform this 3x5 program but I'm also including some hypertrophy work for arms or calves or muscle groups that might not be hit as directly as one might like during the 3x5 component that's okay but do that after the 3x5 training and keep in mind that that additional work can

02:42:56 potentially compromise recovery for the 3x5 power promoting or strength promoting program the example being for instance if one does arm work on the first workout of the week or even the you know the third workout of the week or the fifth workout of the week and that arm work is higher repetition hypertrophy directed work it's reasonable to assume that it might impede some of the 3x5 power promoting or strength promoting training in the subsequent workout so just to be mindful of that and perhaps throttle back on the

02:43:28 intensity or the volume or if my goal is strictly power or strictly strength probably best to leave out other forms of training yep love it one last little thing I don't think we did Justice is intention and the reason I want to go back to this now is because we've talked a lot about specific loads you have to hit and that's generally the case but if intention is there you can fudge those numbers in terms of how much load goes on the bar in fact you can get as low as no load on the bar a great example here

02:44:02 is like a plank exercise so you can do a plank in which you get in a position and you simply contract the least amount necessary to hold the position also you could contract as hard as possible pulling your scapula down and back squeezing your core squeezing your quads squeezing your glutes that is actually going to still help strength production because you're attempting to contract very very hard even though quote unquote the load is the same that thing extends to weight on the bar so you could theoretically see large

02:44:35 improvements in strength at 50% of your One max if you're Contracting as hard as possible and so there's a lot lots and lots of different ways you can train for strength that are outside of this weightlifting weight training spectrum and and if if people if you hear things like this and you're like wow I know I read this book or I saw this other coach who you know was like I got so

much stronger that way well if intention is there those are absolutely possible this could be anything from body weight style

02:45:06 of training it could be very low load Implement stuff so a kettle bell a light kettle bell or a ball it could be single leg training like all kinds of different methods they will only work for strength though when you're past your first you know handful of months of training if intention is there and if it is then these specific numbers and protocols don't matter as much so don't get too caught up in them if you're not worrying about exercise quality and this is very very important because you mentioned

02:45:36 earlier about how you stop taking your phone into the gym with you um one of our former students U Ramsey ninjam is a the head strength conditioning coach at the University of Kansas and he made he made a great post a couple of days ago where he he gave sort of a tip of how do I improve training quality and one of his tips is set your playlist before you go to the gym and the reason is people send spend so much time in between sets just finding the next song that they like it makes their workout so long and

02:46:04 so unproductive so that is one strategy or do what you do which is Ditch the music entirely when you don't have music or a phone to look at you only have one job you only have one thing to pay attention to and what you'll find is the quality of the training will go up exponential ually um you will feel kind of quote unquote bored but that's just means you'll go back to training and you'll get a lot more done because you have one thing to focus on so you can get a lot more done when you avoid those

02:46:29 distractions and when you're doing strength and especially power work since it's not fatiguing uh strength will be a little bit but Power won't be people tend to get very bored they're used to either feeling a a pump or a burn or a sweat or and that's their like perception of my quality of workout these exercises will not hit that for you so there has to be another metric you're looking at which is I'm going to try to move as well as I can as hard as I can that's going to produce your results if you can't do that then you

02:46:59 might as well just not do these workouts go do something else you're just going to be wasting time you're going to be burning a very low amount of calories you'll have wasted an hour and you're going to go right back to the place you were so be very intentional um there are actually some some studies showing that music can enhance performance we've done some of these in our lab so what's that mean it's not about the music per it's about the focus and intent and do whatever it takes to be very focused and

02:47:23 intent and you can actually get in and out very quickly and get a lot of work done and see a lot of results love it okay let's talk about hypertrophy the topic that occupies the minds of so many youth young men but also a lot of women I think one of the really interesting progressions that's taken place in the last decade or so is that far more men and women are using resistance training in in order to evoke hypertrophy growth of muscles for aesthetic reasons and for all sorts of reasons what are the ways

02:47:57 that people can induce hypertrophy so not to correct you or insult you but probably a better way to think about that question is really what stimuli do I need to give the muscle to induce hypertrophy now there are um hormonal factors that are important there are nutritional factors but just to stick with the context of training um this is really going to frame a lot of our answers and as you'll see it's one of the reasons why I call hypertree training kind of idiot proof in terms of programming now the work is hard

02:48:30 difficult and all that but the Precision needed is a lot less than what we saw in power and strength and so if you note there like it's very important that you do it in this style with this intent and with these Within These parameters and if you're outside these parameters it's not going to be it hypertrophy has a very Broad range um in terms of your actual applications and this is why you have and will continue to see countless styles of training that all work I mean I know you uh were mentored earlier in

02:49:02 life by one of my favorite people in this entire field Mike mener like just an absolute character his style was completely different than what you would see in a classic textbook um or or any UN number of different influencers or coaches or individuals and and if you've ever s thought to yourself like why is it all these programs work and people love to jum to things like well that's the steroids like just get that out of the equation for now independent of that or that's not even part of the equation

02:49:30 you're still going to see results and the question is like why well that's because what's driving changes in strength and power are the adaptations of specificity what's driving changes in hypertrophy is much more well-rounded and so you have options to get there remember you're training a movement and now you're training a response and a muscle that causes to growth that's very very different so if we look at like the classic Dogma we have to basically challenge the muscle to need to come back in this case specifically bigger

02:50:06 and the nutrients need to be there to support that growth okay the nutrients aside perhaps we can come in a few more minutes and talk about that so all we really have to do is going back to our our dogma of activation of some on the cell wall we've talked about this earlier that's got to induce that signaling Cascade that's got to be strong enough to cause the nucleus to react to

it to go to the ribosomes to initiate this entire Cascade of protein synthesis okay so that signal has to be one of a couple of

02:50:34 things either has to be strong enough one time it has to be frequent enough or it has to be a combination of these things all right so I can get there with a lot of frequency and a moderate signal I can get there with very low frequency and a large signal like more akin to what you did with with Mike back in the day I'm sure and still train that way still train each muscle group mainly once a week directly and once a week indirectly so all you can all you have to do there to not fail is to make sure

02:51:06 the training is hard enough and it's going to work if you choose the frequency path then you actually have to make sure you're not training too hard to where you can actually maintain the frequency the only wrong combination here is infrequent and low in it and low volume that's it as long as one of those three variables is high you're going to get there because the mechanisms that are needed to activate that signal in Cascade are wide ranging and this is why when we even see things like Blood Flow

02:51:32 Restriction Training right this is when you put like a cuff on your arm or your leg and you block blood flow and you use no load or as low as say 30% of your maximum and you take it to fatigue failure that actually is an equally effective way of inducing hypertrophy despite the fact that you know you're using three 5 10 maybe most 20 to 30% of your One Max why because you went through through the route of metabolic disturbance okay other ways say a higher load maybe uh as heavy as you can for say eight repetitions is

02:52:04 going to get through through what's called mechanical tension and so there's there's these different paths that we can get to the same spot now eventually these things have a saturation point so you don't need all three of these mechanisms the third one of course being muscle damage or breakdown and I and I know we want to chat a little bit about that but none of these three are absolutely required you can have multiple of them in a session um you don't have to have breakdown at all that is a complete uh well really it's a flat

02:52:31 out lie that you have to break a muscle down to cause it to grow that that's just not needed at all you have to have one of these three things though and so again this allows you a lot of flexibility which is why crafting your program which is best for you is actually fairly simple when it comes to hypertrophy just have to make sure you do the work um and you want to make sure you have a few standards in place with the exercise choice and some other things that will um we hit just a second but that's really the fundamental way of

02:52:58 getting to it um making sure either that signal is loud enough or frequent enough to give the nuclei a convincing enough reason to spend the resources because you have to remember two things in order to grow new skeletal muscle you need amino acids which are your supply and then you need primarily carb hydrates as the energy source to power that synthesis process you remember basic chemistry it says if you're going to take two atoms and you're going to pull them apart or put them together right

02:53:29 that's going to take energy typically and in most of actually metabolism uh when you split a bond you're going to get it's called exonic you're going to get energy from that but when you put them together that's going to take energy this is why we call that protein synthesis right so you have to convince your nucleus that one invest those resources in energy primarily carbohydrate but number two and more importantly invest that Supply there's a ton of possible ways to get energy but there's a very low amount of amino acids

02:53:58 available and you need them for many more things than just taking your biceps from 17 in to 18 in right it's not going to do that if you're in a position to where again you can't sustain immune function if if red blood cell turnover needs to be higher or any the other main like tons of things that you need proteins for so you have to be able to say like are you sure you really want to spend these resources and build it into muscle because once we do that it's very difficult to go backwards break them

02:54:25 back down bring the amino acids back into that to that availability pool so we can use them for either another function entirely or even another muscle group um that's called protein redistribution by the way when you say um maybe you you don't do um a lot of upper body work in your training and you're not eating enough protein or a minimal amount and you're doing a lot of lifting in your legs you'll you notice your leg will get larger but that's actually a lot of times you're pulling the protein from say your upper body in

02:54:54 this case and redistributing it back down um to the quad so that's the way you that's what you have to get to and in terms of application what numbers to hit we can go through each one of our modifiable variables um just like we did with speed and and strength and power and walk through some of our best practices in each category yes so I'd love to talk about those modifiable variables as they relate to choice of movements order of movements volume so sets and repetitions and frequency of training and I'm particularly interested

02:55:29 in frequency of training because that relates to the so-called split where typically one is not training their whole body every workout although there are I'm sure hypertrophy workouts that um are whole body workouts but where people are dividing on their body parts on onto different days so uh would love to go through this list one by one starting with exercise Choice cool

great so in the previous section we pretty much said exclusively choose your exercises by the movement patterns and you want to balance between pushing and

02:56:00 pulling and rotation and things like that in this particular case you have the option to do either here's my recommendation most people default almost exclusively to Choosing by body parts here right I'm going to do calves and shoulders today and chest and back whatever combinations of things they want that is clearly effective strategy however uh many Studies have actually been done where you choose by movement patterns and that is actually equally effective now one little caveat I actually should have said a few minutes

02:56:30 ago when we talk about the research on muscle hypertrophy it is important to distinguish the fact that the vast majority of This research is coming from a novice to moderately trained individuals there's actually more and more research coming out on trained individuals but that's still moderately trained right even those ones so what happens and those people that are actually way past that point we we don't know scientifically it's very difficult to do research there so that's an important caveat I will

02:56:56 acknowledge when I say hey you don't need to do this or you have to do this you assuming a training status of of moderate to to low um may or may not be true past that we don't know scientifically I have certain thoughts personally but the science will only take us that far so that being said you can actually choose by muscle um or by movement pattern here whichever is is your personal preference and this is actually where you can act just become a good coach whether you're coaching somebody else through this fitness

02:57:24 journey or it's yourself and give them a little bit of autonomy so maybe you select the first three exercises and then let them select one every day and so if they uh especially want to make sure that one muscle group grows let them Target that muscle and maybe the rest of the day you've actually split it up as Push Pull or something else like that um all those strategies are effective personal preference as long as the total amount of volume on the working muscle is equated throughout the week which we'll get to those numbers in

02:57:51 a second then you're going to be in the exact same spot no problem I would actually generally encourage people to choose exercises um in a variety of Fashions I actually think that it's important that you do some um number of combination of what we call bilateral and unilateral exercises so bilateral being think about it like a squat where by meaning two lateral you have two feet on the ground moving you know in sequence here unilateral is one so this could be something as simple as a um rear foot elevated split squat it

02:58:22 could be a single leg leg press or single leg curl it could be a pistol squat something where the the individual limb is moving one at a time you need to have a combination of bilateral and unilateral training that's good to do for strength as well probably not super important for power but I'm also very important for making sure for I pury sake you're not getting any imbalances um as you progress especially through months and years of training so make sure you're doing a little bit of a combination whether you want to pick

02:58:52 specific implements that's really a methods question and a preference question then it is Concepts so dumbbell great kettle bell fine barbell awesome ban doesn't matter body weight none of these things are as important because all you're trying to do is create a certain insult in the tissue and the Implement is just whichever one you feel best doing it and this is where actually machines come into play a lot machines are greatly underappreciated they are a fantastic resource especially somebody

02:59:23 um who's either early in their fitness journey or somebody who really is having a hard time targeting a muscle group with a bigger compound movement so when you're choosing exercises for AER trophy you're going to want to start with those bigger compound movements that's going to be drive a lot of the adaptation you can get to these single joint movements like a little bit later but having said that because of of the way that people move differently their bom or their anthropometrics and and their bom

02:59:52 mechanics and even their technique the same exact exercise will not necessarily work the same exact muscle groups for multiple people so if you and I both went and did a back squat um if you did a little bit more of what we call a high bar squat so this is the bar is literally setting up higher up on your neck you're keeping your back more vertical and because in order to do that you shift your knees much further past your toes keeping a of course your whole foot on the ground in good position okay

03:00:21 that's going to generally put more of an emphasis on the knee joint right and so that's not a bad thing um you tend to see a little bit more work in the quads there a little bit less work in the spinal erector and back because you're actually not supporting the weight horizontally which is a diff it's a much more difficult position it's it's vertically stacked okay if I were to do it in the classic low bar squat which is again lowering the bar down my further down my back towards uh L like my shoulder blades I

03:00:49 probably take a little bit of a wider stance and when I squat I drive my glutes back further away from the midline in as in fact as a general rule if you take the midline of your body the thing that moves the farthest away from that midline is likely to be the thing that's activating the most so in the case of the of the front squat um you're not generally going to be using your glutes as

much if you're in that are not even front squat just that high bar squat where you're very very vertical your knees are going to be moving very

03:01:15 far over your toes which is fantastic therefore a little bit more knee dominant as kind we say it the other version here you keep keep your shins really close to Vertical you move your butt backwards you're going to have to then lean forward with your torso which means it'll be more low back more glutes and a little bit less knee now that's a general statement it's not necessarily always true but as a guideline there that is one exact exercise where you may be going man I'm trying to improve this

03:01:41 clear weakness I have in my quads I can't even leg extension my body weight I have a significant problem there so maybe in your particular case if I'm hammering you or you're hammering yourself in a squad exercise and you're wondering why your quads aren't getting any stronger or aren't growing in any size it may be because of the style of the movement so I may need to go Andrew all right look squats in general if you look at the research are an excellent exercise for Quad development but for you they're not because of the way you

03:02:08 stand or just because of you know neural activation it doesn't matter so I need to take you to a machine and isolate that muscle group so we can make sure we see development in that so if you're trying to grow a specific body part uh area individual muscle it's very important that you're actually seeing progress there and don't worry about well in the textbook the bench press is supposed to be good for your PEC because if you're not actually moving the right position or it depends on the angle in

03:02:33 which your sternum actually sits in your body a a bench press may actually be doing very little for your PEC and you may need to adjust to say an incline bench or a decline bench or a peck fly so machines can be fantastic at letting you isolate without having to worry about things like stab ability um your low back position getting hurt where's your neck at you can really concentrate on just the movement concentrate on the muscle and let everything else kind of go away and ensure you're getting

03:02:59 training in that specific area those are excellent recommendations one thing I want to ask about is prioritizing specific body parts and therefore specific exercises and here I'm not necessarily referring to trying to bring up a so-called weak body part you know a area that tends to be either genetically deficient cuz in some cases I learned for instance having seen a lot of um competitive track and field championships I love watching track and field as a spectator up to Hayward Field in Oregon whenever there's a meat and

03:03:30 sure really love that the sprinters are amazing um they have some of the highest calves in the world that I've ever seen I mean like little like little micro calves but they're fast as hell they're right behind the knee and they have a very long distance between that calf and their foot which makes it propulsion excellent right they wouldn't stand a chance as a competitive bodybuilder nope but because something different is being selected for in bodybuilding but obviously they're they're um magnificent

03:03:57 for sprinting most people of course reside somewhere between the extreme of you know very long muscle bellies from you know origin to insertion um or very very short muscles usually people have one or two body parts that they want to emphasize for whatever reason you know these days it seems to be um people are really uh what are they saying now like glutes are the new biceps or biceps or the new glutes or I don't know anyway you see this stuff I love them both by the way I am so Pro curls in the squat

03:04:25 rack there you go love it right there you go so nobody kill me so everyone has their thing but the that they would like to emphasize but I have a question because we're specifically talking about hypertrophy which is should people give themselves permission to not train a body part if their goal is balanced hypertrophy I'll give a couple of examples one of the reasons why for instance not done a lot of free weight squatting is because despite my quadriceps being rather weak according to you um they tend to grow

03:04:57 rather easily relative to other muscle groups and the goal for me has always been balance development Y and so I emphasize hamstring work and I emphasize you know calf work and hamstring work um it's not that I don't train my quads at all but I do far less for them and I avoid the big compound movements for them I occasionally do them and what again this is not about what I do or don't do but I think that in the context of a conversation about hypertrophy is it appropriate to give people permission

03:05:26 to say listen if you're just genetically H uh you know strong large lats doing a lot of chin-ups and rows might actually be the worst thing for you if your goal is balance development and I um I ask because I don't often hear um anyone any you know credential people give people permission to completely avoid training a given body part if their goal is balanced development and yet I think most people who are resistance training are seeking balanced development I don't know anybody that actively wants to have

03:05:58 big upper body small legs I think that comes from neglect and laziness in most cases sometimes it's injury related or other things but um I think this is an important point to raise that any good program for hypertrophy I would think would have to take into account people's genetic and natural variation um sport based variation in which muscle groups just tend to grow

easily for them and which ones require a lot more focus and work yeah absolutely you first of all you have permission to do or not do

03:06:26 anything you'd like to do in terms of of hpy training uh I generally would not recommend disregarding a muscle group entirely I know that's not what you actually suggested but just to make sure that people didn't hear it that way um what I would do is in this example is I would continue to do those big movements I would just keep the volume low so I might do two sets or something uh twice a week um there's a whole bunch of reasons you want to make sure that those motor patterns are there um you want to

03:06:52 make sure that the the especially the benefit of these compound movements is you get to work so many complimentary muscle movements at the same time so in the case of like loaded squat you're not only working stability in the hip um as well as the knee but you're also working upper body uh your your rhomboids are keeping you in position your neck has to stay in position your toes everything is working and so it's really difficult to get those things when you take uh that move movement out and you replace it

03:07:19 with say a a machine hamstring curl that whole element of balance neurological control is very very important to maintain over time and that just gets removed with if you go to machines only so um I I would keep some of those things in maybe even not all year round but maybe one quarter of the year two quarters every other rotate it something like that um as long as it's getting you're not if the reason you weren't doing say those squats was uh because you're like ah it hurts my back or okay great then leave it out but if it's just

03:07:47 simply you don't why your quads grow too much I would just keep that volume low and do something just to kind of touch it keep it activated uh and to maintain all those other things like um flexibility range of motion I would bet anything your adductors are probably underdeveloped right now you can get those by doing your squats because you're not really doing I'm sure much adduction training and so there's things like that that just get lost when you're only thinking all big muscle groups um that that come inherent in doing the

03:08:14 larger movements and so you don't have to worry about them or train them separately I appreciate that and in reality I do two to three really hard work sets of hack hack machine squats per week yeah which is plenty for me to maintain and even get a Little Bit Stronger but per our earlier discussion about a year ago I shifted to doing very low repetition ranges to main strength in that movement but I am actively avoiding hypertrophy in that muscle group yeah or another solution would actually be do something like one set to

03:08:45 failure a week not even extremely long just you know do something in the 8 to 15 repetition range um at the end of all that strength set and just get a little bit of pump there and then and then just just so just so that those muscles can touch that level of fatigue touch that level of strain and mechanical tension Walk Away Great thank you for that what about exercise order amazing so implicit in this exercise Choice thing it it's what you're going to notice is these modifiable variables interact with each

03:09:14 other right and you can clearly see how when we talked about volume And to clarify volume is the repetitions multiplied by the sets that's typically how we express volume well that's going to be directly influenced by intensity the heavier load you put on the barbell the less repetitions you can do and the inverse right uh rest intervals the shorter you keep your rest intervals then either the lower the weight has to go the intensity or the lower the rep range has to go order is the same thing choice is the same thing so all of these

03:09:39 things modify each other they play a little bit of a hand in in what everything else does so with the exercise Choice thing rolling into exercise order you get to play a couple of games here when we talked about strength and power I basically said stick to the big movements most complicated compound movements first you don't have to do that with hypertrophy you can do this in a couple of ways you can do the thing you're just simply most interested in first you can do this thing called pre fatigue so say you're

03:10:07 you're going to do a back day you could go in and do nothing but isolated biceps as your very first exercise and then roll into uh your your pulling movements because what you'll see is during most pulling activities the biceps are a secondary or tertiary muscle group but you've prefatigued them you've guaranteed that muscle of most interest got its its most training in and everything else is secondary so you can start if you want with single joint movements you can start with isolation stuff or you can start with compound

03:10:33 stuff um either way it just really comes down to preference and what you're specifically trying to develop now this also goes back to the exercise Choice question right because it's it's sort of the same thing right like which one am I choosing and where I want the capus was the exercise splits and and so you sort of talked about am I doing body part splits and I know a question I get a lot here is well which ones should I package together I'm not really concerned with it what you all you should worry about

03:11:01 is how many times per week and in fact total volume you achieve on a muscle group per week and I don't doesn't really matter how those things are folded in it's really a personal preference issue um one mistake that we see here commonly is grossly under apprting that the legs are not a muscle group right so the legs have a whole bunch of muscle groups in them so

we see a classic split like I'll Do shoulders and chest Monday and then I'll do you know biceps and forearms Tuesday and then legs Wednesday or whatever and then

03:11:38 back to upper body and then I was like you're like wait a minute you have four days dedicated to the upper body and one for quote unquote legs well like you hopefully you can see the imbalance what's that's going to happen there over time is you're going to do do far more upper body than you are lower body and that's not appropriate so you just want to think about your lower body like you would do if you're going to do body part splits then include those things as well and don't just chunk everything in as legs

03:12:03 once a week if you want to do that that's actually okay but that day has to be very very challenging and you probably should do quite a bit of volume U there because you're you're almost surely not going to hit the total weekly volume needed to optimize muscle growth if you're literally only doing one once a week of your quote unquote legs so along those lines Let's Talk Volume yep how much volume does each muscle group need per week in order to generate and for that matter maintain hypertrophy

03:12:32 right so the the kind of minimum number we're going to look for here is 10 working sets per week correct per muscle group correct and um just to make sure that everyone's on the same page if I do a chin up or a pullup I'm going to mainly be training my back muscles my lats if I'm doing it correctly lats and rids and biceps right and if so but they'll be indirect targeting of the biceps so would you include indirect targeting so for instance if I you said 10 sets per week let's just use biceps because it seems

03:13:06 that that's the go-to uh generic muscle for what why is that by the way that when people ask somebody to you know Flex their muscle they always Flex their bicep they don't flex their calf or their quad or their glutes or something I guess there's some um you know public decency issues I can tell you uh with my children that's the very first muscle I taught them to flex they're glutes no they're they're B I was gonna say good um good uh healthy parenting advice from Dr Andy yelpin so if it's 10 sets per week for biceps in order to

03:13:38 maintain or further grow the biceps but does that mean if somebody does 10 sets of chinups or 10 sets of chin-ups in rows that are checking off any of the boxes for biceps assuming that they're doing the movement properly yeah and targeting the major muscle group that a given movement is supposed to Target which in my mind when you're doing a chin up you're supposed to mainly be using your back muscles and then there are secondary muscles or secondary activation of other muscles but of course some people their arms

03:14:09 grow like crazy when they do chin ups and their bag doesn't grow at all so this is where we're back to the kind of um genetic preloading of the system yep um if you will so how does one meet this 10 sets per week minimum when dividing different body parts and thinking about this direct and indirect Activation so two things there's no specific exact rule here and this is why these set ranges are ranges right and this is why why we don't say like 10 is so 10 would be sort of the minimum number you want to get to the more

03:14:39 realistic number that most people especially if you're Advanced or even intermediate is more like 15 to 20 working sets per week week okay now if you're very well trained you probably want to even push more towards like 25 and in fact um past that there's just not a lot of research so the optimal number may be 30 we don't we don't really know it's just hard to get that much work in um it may actually even be detrimental and here we're referring to Natural athletes that is people who for whatever reason either because they're

03:15:09 not taking any prescription drugs or maybe if they are whose levels of steroid hormones mainly the andrens like testosterone Etc do not exceed the normal reference range values either because that's what they are naturally or that's what they're replacing through pharmacology whereas when we think of technically someone could be taking exogenous hormones to replace a deficiency and then they're still in normal range okay but I just want to um clarify because you work with athletes a number of different sports where drugs

03:15:41 are and are not tolerated Etc and the general population that what we are talking about here is for the general population not for steroid using athletes correct okay yeah great so um so 10 was sort of that like absolute minimum number to maintain which is actually pretty cool if you think about it this way uh if you went in and you did three sets of 10 it's a very stand three sets of 10 repetitions correct you're already at three you did that three days a week you're at your nine that's almost 10 if you also just went

03:16:10 to the gym one day a week you did three sets of 10 and you did three exercises you're at nine working sets you're BAS basically done so achieving 10 sets per week per muscle group and now we're not even talking about indirect activation of a secondary so you're you're going to hit 10 fairly easy um extension to that hitting 20 is actually still not that hard because of what's actually going to happen there so in your example if you're doing your chinups um well would the biceps count there's no exact rule there because uh

03:16:42 there could be technique issues it could be hand position so you mentioned chin up very specifically a chin up is actually to put your hands in in this position where your palms are facing up right this is superation and pronation so you're going to be there well that's actually quite different than a pull-up or your hands are are in the opposite direction so um a chin up actually is

going to be pretty good activator of your biceps for most people um so you would expect actually to probably count

03:17:05 that because it's going to be very difficult to not see some fatigue in your biceps depending on your mechanics depending on and by that I mean just the segment lengths of your bones right that's where your muscles originate and insert there's nothing you can do about it's not even a technique or a focus issue it's just simple fact the matter of that's how you pull best in that area um the position in which your hands are um on the Barra wider grip more narrow grip it's going to change muscle use so we talked about um earlier

03:17:34 I think in the previous episode that exercises do not determine adaptations applications to but exercises do determine things like the movement plane The Joint you use and typically the Eccentric concentric sort of ratio as well as often times the muscle groups involved so there's just not a lot of things you can do depending on how you are built of you know some exercises activating a secondary group and you don't want it so it's not always a technique issue it may just be that's how you're built right and the same

03:18:05 could be true for a squat um the high bar versus low bar sort of example we talked about earlier it's you know you can see plenty of evidence on um muscle activation studies where people even doing the vertical back squat style have tremendous glute activation and folks doing the the low bar have tremendous quad Activation so a lot of it depends on personal mechanics so what I counted is the question really you just have to ask yourself number one do you really care that much you know you

03:18:34 have a range to get to if you were anywhere between 10 to 25 working sets you know you're fine so if you count it or don't count it it's just going to change the difference between whether you did 17 working sets or 23 and either way you're fine so I don't really care number two are you actually feeling anything there so if you're doing your chin-ups and your biceps are blowing up I'm counting that right if you're doing it and you're like no I don't feel any fatigue there it's all my then I'd probably say okay we're not going to

03:18:59 count that as as towards so um you can just let that guide you a little bit towards your account yeah I've always noticed that there are certain muscle groups that are very easy to isolate yeah when underload and those are almost always the same muscle groups that are easy to contract very hard without any load whatsoever Bingo you know that's actually really insightful so um you can kind of use this Urus stic of like if you can contract your lats just standing here you're probably going to contract

03:19:31 them very well when you lift if you can't you can probably assume about the same thing's going to happen so uh yeah you'll know um this actually the ls are actually really interesting um because they tend to be one of the more difficult muscle groups to learn how to activate so if you're in your Journey you're just like I have no idea and um you can look up like a lat pose so how do you like how do you pop your lats out how do you show it and if you do that and you're like wow there's no movement

03:19:56 here just recognize that's extremely common and that it's probably going to take you many many many months of trying before you start to see some movements and probably even a few years before you really start to see Activation so you're you're not some sort of like specific like special genetic anomaly it's very very common it's uncommon to not be able to activate your biceps right that everyone can do that but if you're just like man I can't get this here I'm just going to stop doing it do not do that just keep at it and just

03:20:24 keep concentrating and thinking about that muscle group it will take some time it's very common to to have challenges activating lats yeah I've noticed that many of the muscle groups that were responsible for a large fraction of the work in the various sports that I played as a young child are muscles that are very easy for me to selectively isolate and induce hypertrophy in um I suppose I'm one of those mutants where my lats happen to be one such of those muscle groups I think that's because I swam a

03:20:55 lot when I was a kid was literally going to ask you a swimmer that's like a Telltale sign yeah everyone every kid in my town swam and played soccer there go and then later I you know I skateboarded and did some you generally hear that answer you either were a swimmer or you a wrestler so it's like that pulling and pull toward you is thousands of repetitions allowed you to get very good at Contracting MH but because um I also played soccer and skateboarding but I didn't do any baseball basketball or

03:21:23 football muscle groups like deltoids are very challenging to activate and isolate so I do think that early development is superimposed on a genetic template that sort of predicts which muscle groups are going to be easier or harder to isolate and and train it's also a very good case for why it's important to do as many different athletic activities as you can in your youth yeah and if you do skateboard definitely learn to ride switch because every every skateboarder I know has one leg that's larger than

03:21:52 the other and one calf that's larger than the other and actually for that matter um people that do martial arts that don't learn to um if they're not Southpaw if they don't learn to switch up and do their uh their work Southpaw you see the same thing I mean you're building an asymmetry into the system and it's not just muscular it's neural strongly neural um so yeah kids um

parents get your kids doing a bunch of different things I suppose gymnastics would probably be the best sport all around in terms of um movement in

03:22:20 multiple planes and activating all the different muscle groups uh yes and no um there's a lot of benefit no question about it there's a lot of other things though that it that has limited ability so um almost everything in not like gymnastic is great but almost everything in that is pre-planned which is a major downfall right so the joy of skating is there's so much proactive input that you have to make decisions very quickly um in in small Windows now you have a little bit of that when you're flipping

03:22:46 in the air you have to land but you gymnastics gymnasts tend to have a very specific routine that they're working on and they work on that routine for years so for me was Transportation it was freedom and it didn't require any coaches or parental oversight yeah yeah Ball Sports have the beauty of of reaction and things like that so all of them are wonderful um yeah good to do a lot of them you've established that 10 really to 20 sets per week yeah is the kind of bounds for um maintaining and

03:23:16 and fitting hypertrophy yep if I were to like flag one of them I would say 15 to 20 is the sets that you want to get working now it gets complicated when you ask well how many reps per set do I have to get to okay well we also can complicate that by repetition type and Tempo just sort of let all that go for now and just think if you're getting close to that range you're in the spot and all you have to do now is balance two things recovery and continued training okay so if you're somewhere in this 10

03:23:49 to 20 working sets range and you're in a position where you can continue to do that you're not so sore and so damaged and beat up that you can't maintain that volume for you know eight weeks at a time or at least six weeks at a time then I'd probably say either the style of repetitions the amount of repetitions per set you're doing are too much the volume is getting to you however if you're not seeing adaptations then I'd say maybe the repetitions aren't enough and so that's like that's the kind of

03:24:16 game you're running now there could be plenty of other factors intensity of course yeah intensity um intent and then of course the other things sleep nutrition Etc all these other things that go into our visible stressor category that we always analyze this is sort of brings up this idea of responders and non-responders so we get this one a ton so why is it some people uh my my gym buddy my roommate we go to sleep the same time we're on the same nutrition plan we work out together uh she triples in muscle size and I don't

03:24:47 have like no gain whatsoever well there's a lot of um work that we're trying to do to identify the molecular mechanisms behind responders and non-responders because they clearly exist in fact this is one of the reasons why uh every paper I basically will ever publish again if I you know if I do always reports individual person data so rather than group averages you get to see you know if there's 10 subjects in it you get to see how each of the 10 responded because the group average can get confusing what you really want to

03:25:15 see is how many actually people got better how many got worse um how many maybe changed and if so um so we'll always report those individual data cuz when you go to train you're you're you're not the group average that's very important to know right so if you do that you can see a beautiful line of these hyperresponders the bell curve in the middle of the normal responders and those folks who like through any training study just won't get any better um if you can tease out which you can't but let's say in science you could tease

03:25:43 out all the extra factors total stress load hydration sleep Etc what you often see is non-responders a lot of the time it's not that they have a physiological inability it's just that they they need a different protocol and a lot of times it's they just need more volume so if they can handle that and they're not excessively beat up just give them more volume and they tend to see a lot of breakthroughs um you see the same thing with plateaus um so typically sort of just like okay the routine you're on

03:26:09 you've been on it for too long we need to either go to the other end of the hypertrophy Spectrum for intensity which means like if you've been in the like six 60 to 70% of your one repetition max range maybe we actually need to go heavier take our repetitions down maybe even our total volume down and go heavier try that a great way to break through plateaus of of grand if all the other boxes are checked um the other one is is do the opposite which is like okay we're going to go higher we're going to

03:26:35 go set to 20 set to 25 High very high repetition range and really get after it um not do as much damage because you don't tend to get as sore from those really high repetition ranges you'll get more sore from the lower repetition higher intensity range than you will typically the other ones and and see if we can blst bust through some plate there so it just generally means you need to do something a little bit different than your your training partner so we've talked about exercise choice and we've talked about the number

03:27:02 of sets that one needs in order to induce hypertrophy per week what about repetition ranges you've mentioned some pretty broad repetition ranges how many repetitions per set is required in order to induce hyper yep so there are two caveats here before I give well the number is somewhere between like four to 30 reps 30 repetitions absolutely in fact I think you can

go much higher the first 20 have to be feel exceedingly light correct and during those first 20 or so repetitions is the goal still to

03:27:35 contract the muscle as hard as possible on each repetition so this is the caveats here so caveat number one is there is an assumption that by the end of the set you're getting somewhat close to failure and so you don't have to go to Absolute failure um to to induce mostly py but you you also have to get kind of close so if you're going to do a set of 25 and you finish it and you're like oo yeah like that was kind of starting to get hard at the end that's not going to be enough if you're going to do a set of

03:28:09 five or six and the same sort of expression comes out of your mouth it's not going to be so in that case it doesn't matter your rep range if you're not getting somewhat close to failure again it doesn't need to be complete failure um a good number to think about is like minus two which is what we call reps in reserve which is sort of like I got within two or so reps of failure and then I stopped and can we Define failure at least for sake of this portion of the conversation as the point at which you

03:28:35 can no longer move the resistance could be your body could be a weight machine Etc that you can no longer move the resistance and more in the concentric phase of the exercise movement in good form correct that's a really ni momentary muscular failure is is how we typically Define it there's a wonderful review I think it's open access uh that just came out in the last handful of months Eric Helm's team out of New Zealand Eric is a is a great scientist uh and a very experienced physique coach and a competitor himself so he knows a

03:29:09 lot about this area um and that paper rent through all the exact definitions in detail all the caveats that we not going to have time to get into today so I would recommend folks like check that out if they want more information but I'll I'll try to get to the highlights of it right here so what they basically showed is going all the way to failure in the defining failure like you just did right so momentary muscular failure you can't complete another repetition through complete range of motion through

03:29:36 whatever range of motion you determined prior to as well as with good technique so other body parts aren't being compromised sort of Etc um and doesn't need to be total failure that minus too failure is still needed in caveat 2 which is again very very highly trained individuals you won't see people who are like Eric or other folks who are six to 8 to 10 years into very serious training um who don't have to go to failure probably a little bit more than what I just said so the the layout that they brought in their paper was

03:30:09 very nice and they basically said okay here's a couple of scenarios in which going to failure is maybe the best way to do it um number one you probably should do it on a little bit of the safer exercises so maybe taking your back squat on a Barb to complete failure and doing that as like a standard protocol multiple times a week it's maybe not the best choice so maybe if you're going to do barbell back squats you take that to your you know your one or two reps in reserve stop there it's a lot of work at actually going

03:30:40 back to our discussion of the prpp and chart it's a similar idea right where you're going to spend most of your time in these working sets 70 to 90 sort of percent and then you're going to take that failure to maybe the hack squat machine or maybe even the like extension machine so a little bit of a safer exercise they also can tend to be single joint exercises don't have to be but they're just ones that are not as complicated and you're not likely to injure other body parts when you're doing it all right um so that's one one

03:31:07 way to go about it another way to go about it is simply doing it on like the last movement of the day right and so again you're not going to do it on your first three or four exercises but whatever your last finisher is you'll hit total failure on that one and that kind of keeps you in a range of yeah you hit some failure you got a lot of overall work done so that's a lot of stimulus that's a lot of noise going to that nucleus that says grow grow grow grow grow but you didn't totally obliterate yourself um especially if you

03:31:36 don't have the assistance of anabolic steroids right that's very very important if you have those you can push this a lot harder because your recovery would be significantly enhanced if not um you kind of want to walk away from that I have to assume that you know 99% of people listening to this do not and um and yet among those who are not taking anything um in terms of anabolics there I think there a large range of recovery quotients out there some people just tend to recover better some people

03:32:02 I think also are far more diligent about what I would call the um necessary but not sufficient variables of yeah adequate sleep yep uh proper nutrition um limiting stress and and so on yeah I can't wait to break all that stuff down we got a whole got a very long discussion for all those things we will get into it in all its practical realities and actionables um before long what about rest between sets great this is the interplay now so one actually thing we said for a long time is you want to stick between 30 to 90 seconds

03:32:35 of rest between sets for hypertrophy and that's because you're trying to um activate this metabolic disturbance or disruption um you need a little a little bit of a burn a little bit of a pump to go there more recent research a lot of this out of Brad Shultz's lab and others have shown that that's just doesn't seem to be the case again for moderate uh to to newly trained

individuals whether that's the case for the highly trained folks I don't necessarily no um I don't think there's any difference here um so you can take

03:33:05 up to three to five minutes of rest in between sets and be fine the caveat here though is this if you're going to rest longer that means the metabolic challenge is lower so you need to then increase the challenge in either mechanical tension which think about is weight load or muscle breakdown so you can't lower one of the variables keep everything else the same and expect the same result so if you're going to have more rest then you need to either preserve um the load on your bar or the volume one of the two has to happen so

03:33:39 this gives people a lot of opportunity I generally tell people if you're going to train for hypertrophy it's probably best to stay in the 2-minute range at most you can go longer but a lot of people have a hard time actually coming back and then executing that next set with enough intent to get there and or it's going to make your workouts tremendously long so you can stick to the shorter one um you don't have as much mechanical tension but that's okay you can still get there but in reality of it is you can do

03:34:09 whatever you would like tell me if this is a reasonable structure given what you've told us three exercises per muscle group first exercise slightly heavier loads so repetition ranges somewhere between let's say five and eight with perhaps hitting failure close to it on the last set rest periods of somewhere between two or let's let's get wild and say five minutes okay so it's a little bit more of a strength type workout at that point but then moving to a second exercise of three or four sets where the repetition range is now 8 to

03:34:45 15 shortening the rest periods to 90 seconds or so and then on the third exercise repetition ranges of 12 to 30 this number 30 kind of makes me wide eyed ||| I can't remember last time I did it said of 30 thinking it was for hypertrophy but what you're saying makes absolute sense is research back so very short rest intervals maybe 30 seconds between uh between sets would that allow somebody to Target all three forms of major adaptation um I mean my in my mind it works you know you're talking about mechanical loads you're

03:35:23 talking about stress and damage and you're talking about metabolic stress is that better than to for instance do all the high repetition work in one workout per week um and then higher loads in the other workout it does it matter if you divide them up or combine them it it would not matter I would say it matters in the sense of your personal practical situation well long rest for me I love training heavier with longer rest right but I'm hearing that there's real value to doing these higher repetition ranges yeah so the

03:35:58 formula you set up there in a second is great if you want to do it the other way that's fine you really it's kind of idiot proof you can set this up however you'd like you could actually do the inverse theoretically you could do the sets of 30 first and then move to your sets of 80 it doesn't really matter um because we're trying to just get to a certain total stimuli and you're going to hit it eventually so you have a lot of room to play here you also have a lot of room to adapt based on your

03:36:24 circumstances God I'm short on time today typically my workout takes me 60 Minutes for this plan I have I've only got 35 today what do I do well if you're training for strength that's a different answer than if you're training for hypertrophy if you're training for hyper Fey you need to make sure you hit that total volume so in this particular case lower the load lower the rest intervals and just get to the burn and get going as much as you can if you're training for strength I would rather you cut your volume in

03:36:53 half get those few repetitions done at that high load and just don't do very many sets today that's a better result so the goal that you're going after is going to determine what we call chaos management which is that thing like that um running out of time today my time is short or you didn't even think my time was short something got cut off I'm not feeling it today I'm in a hotel etc etc etc which is life right that's going to be 10 to 50% of your workouts it's going to be chaos management well

03:37:22 how you make those decisions is going to go back to understanding number one what goal you're going after and then number two what are the physiological consequences we call these physiological limiters for each one and that's going to tell you what to select and prioritize the volume the intensity or whatever else I'd like to ask about frequency but I'd like to frame it a little bit differently um than that I'd like to ask about total workout duration which dovetails with frequency because if one is hitting the

03:37:55 appropriate number of sets per week and one is combining different muscle groups on the same days well then workouts are going to be a very different duration than if one is doing a different body part each day for instance and so I feel like any discussion about frequency has to be within the context of workout duration and vice versa yeah if you are a lifting junkie and you're very consistent in your schedule I'm actually okay with body parts but most people are not that and so the concern there is if

03:38:26 you say are isolating and waiting to do your glutes on one day of the week and something happens on that day you might go another 13 days now before training it you know between workouts and that's really difficult to maintain the frequency won't be high enough unless the load and volume on that one day is astronomically High it's just not going to happen so while if

you look at the research um frequency in terms of how many days per week doesn't matter that much as long as the total load and failure are

03:38:56 equivalent practically it's a challenge so it's it's hard because life gets in the way for most people especially if you have kids and a job and all these things over there so I actually prefer doing something more like 3 days a week of total body and if something happens you've just missed that body part for 48s hours 72 hours I like that a little better for most people not because it's more effective but just because it it's a little bit more resilient to life and you can get there um if you wanted to actually do a little

03:39:27 bit of a combination so if you wanted to do like two days a week of whole body and then two days a week of a little bit of a body part split then you're actually sort of hedging against all risks there um as long as you get to that total number there now there is actually some evidence in a couple of ways that maybe a little bit more frequently is a little bit better but the difficult is now we're going back to the practicality question of like how many people really can train just their strength training six days a week and

03:39:53 that doesn't count any of their long duration stuff it isn't their high heart rate their flexibility their okay it's just really really hard to get all that stuff in so it is it tends to be easier on folks in terms of execution and long-term adherence in my opinion um to get that volume accomplished in in um a little bit more frequent patterns but not once a week so I like to kind of have it right there for most people um not again not because it is technically quotequote more effective but because

03:40:23 you're less likely to fail to progress because of skipping a workout something popping up your power going out and your you know garage door being locked on you or whatever imagine that that happened to me this morning folks couldn't get out of my driveway because a gate electronic gate was uh down because the power was down anyway solve that problem yeah the way you describe it my sense is that workouts will last somewhere between 1 and two hours of real work is that about right it doesn't have to be

03:40:52 nearly that long I mean you could certainly get enough to work done in 30 minutes if you even a whole body workout yeah yeah absolutely so if if you're doing that three days a week so remember the numbers we're trying to hit here let's say we're trying to hit 15 working sets per muscle group per week that's five working sets per day per muscle group so if you did one exercise for that day let's say you did squats you did five sets you did that three days a week you're done there's your 15 but there are other muscle groups to hit

03:41:18 on that same day you're doing squats if you're doing a whole whole body corre yeah so you've gotten them all already and so like all the leg muscles in that example are taken care of ah so you would not do separate hamstring work necessar you need to now I hamstrings is actually a little bit of a cave like that's a good example of an exercise or a muscle group that's probably really good to make sure you isolate it's challenging to get with your standard uh dead lift and and squat um it it's one

03:41:43 of the probably ones that's most important to go Target outside of that but in the theoretically though outside of that you would get most of your leg muscles done with even a single exercise and even if you wanted to change it up so you said all right Monday I'm going to do a squat variation uh Wednesday the next day LIF I'm going to do some sort of deadlift hinging variation and then maybe Friday my third day I'm going to do some sort of unilateral uh maybe rear FL elevated split squat or something

03:42:09 like that all right maybe even a lateral lunge maybe a different plane okay you're in a pretty good spot you're going to hit most of those muscles um to your 15 working sets especially if you take sort of that last set each day a pretty close to failure that's going to get some serious work done but you're not going to be so fatigued you can't come back and train it a couple of days later and you'll be fine so you could even split that up into two days a week and now all you really have to do is hit

03:42:34 something like seven working sets so maybe that's two exercises per day maybe some sort of a leg press and a leg hinge you know three to four sets each you're going get six to eight sets that day you did that 3 days a week now all a sudden you're at that 20 24 sets about being a bit boom same thing with the upper body I just gave lower body examples because you know I like the lower body more so it's not that challenging to get to those numbers and split and those workouts can be extremely short so if you're if you were

03:43:02 doing that three days a week um you know you're you're doing that one exercise upper body one exercise lower body that certainly shouldn't take more than 40 minutes I'm happy to hear that not because I don't like training yeah please please excuse the double negative but I found that resistance training workouts that extend longer than one hour of work and certainly longer than 75 minutes of work leave me very fatigued oh sure and fatigued to the point where concentrating on cognitive work throughout the day um can be

03:43:31 challenging need a longer nap in the afternoon I'm a big proponent of naps in the afternoon in any case but requiring longer naps in the afternoon ETA so at least for me restricting the resistance training workouts to about 505 0 to 60 Minutes of real work yeah for me three or four times per week has helped tremendously so it's a case where doing higher intensity work in a

shorter period of time and actually hitting muscle groups less frequently for me that's again once directly once indirectly has worked really well and

03:44:05 as you mentioned earlier this could very well be explained by not my recovery quotient as some sort of uh genetic or physiological variable but the way that I'm training and indeed I like do a few four straps and go to failure on too many sets and you know weaned in the in that um genre of training it's also fun like to just train hard it is it is I think that um I've learned a lot by training to quote unquote to failure um I think there's a lot of learning in there um provided it's done safely but

03:44:33 what you're describing actually inspires me to at least give a try to these other sorts of splits and ways of training for hypertrophy and strength because this notion of not necessarily having to go to failure and still being able to evoke strength and hypertrophy um adaptations is a really intriguing one uh dare I even say a seductive one and that leads me to a question that is based on findings that I've heard discussed on social media which means very little if anything unless it's in the context of people who really um know

03:45:04 exercise science and um you're one such person and that's this idea that because resistance training can evoke a protein synthesis adaptation response but that adaptation response is lasts about 48 hours before it starts to taper off that the ideal in quotes frequency for training a given muscle group for hypertrophy is about every 48 hours is that true yes and no so a couple of things there remember in order to grow a muscle there's multiple steps here so you have the signaling response which actually happens within seconds of

03:45:43 exercise and can last depending on the marker you know up to an hour or two hours step number two then is gene expression and we see that that's typically peaked around 2 to 6 hours post exercise and then you have following that protein synthesis and that's that longer time frame somewhere between 12 hours there it's certainly not peaked for 48 hours it may be still there 48 hours from now but it is is absolutely coming down at that point depending on sort of a number factors so that that part of is sort of TR so that

03:46:12 this is a combination of like some half truths and some like maybe just pedantic things that aren't really that important to differentiate the real question I think is is like okay is it okay to train sooner slash is it better to train sooner or actually is it better to wait longer there's no real reason to think that you need to train if the goal is hypertrophy any sooner than 48 hours afterwards I can't think of an advantage that that would confer I also can't think of any practical applications athletes physique

03:46:45 bodybuilders coaches that ever found tremendous success doing that so I would be very skeptical that that is any way better now could you do it in some instances of say you know you've got travel coming up like that so that you just yeah course you want to preload the system by destroying the muscle no problem and then waiting seven days or 14 days I've known people have done that before Vacations or layoffs I every time like every single time to annihilate themselves and then take a two week layoff

03:47:12 yeah and it's like there's no benefit there other than psychological like I just love it like it feels great to be super sore I feel less crappy not training for those couple days cuz I'm like I'm super sore anyways you need the extended rest yeah of course and it's just like it's just a crappy justification in my brain that like I excuse to do something really wild and that I totally don't need and get way sore than I should get Dr Andy Galvin suggestions of what not to do but that he does yeah

03:47:39 100% do as I say not as I do the famous words of every research Professor yeah I think 48 hours is a reasonable time uh to wait can't think of any advantage of going sooner than that there's really not a tremendous amount of advantage of waiting much longer than that certainly 72 hours is fine um as long as you're hitting these Concepts we've talked about you can let really life determine that um I mean there's situations too with like particularly our athletes where we have to kind of break that

03:48:05 because of schedule obligations they're playing every fifth day every third day or something like that you're just going to have to lift on back to back days you're just going to have to get it done um but yeah I can't think of why I would go out of my way to do that the second part of that question is let's say somebody trains a muscle they train it properly they hit it in the appropriate rep ranges and appropriate rest Etc that the stimulus is there the adaptation is set in motion they're getting

03:48:34 somewhere somewhere at 48 hours or so a protein synthesis Peak that's going to taper off yeah but they don't train it 48 hours later or 72 hours later they train it five or six days later not because they're lazy not because they um they don't care but because they have other priorities that are woven in with getting hypertrophy in this muscle right there are people who exist only to get hypertrophy in a given muscle group but let's be fair most people would like to grow that muscle group but then does it necessarily mean

03:49:05 that the muscle starts to revert to its prehypertrophic state that is does it atrophy and get smaller again because if it doesn't I could see a lot of reasons for hitting a muscle group once every five 5 days or seven days provided you hold on to the hypertrophy that you initiated 5 or seven days ago yeah there's no reason to think you would lose anything in that sort of a Time

domain five to seven days the only challenge with training that infrequently is can you actually get enough total volume done so if you're

03:49:31 going to train a muscle once a week you either have to go to real failure real damage and soreness or you have to figure out a way to hit 20 sets that day in that muscle not at all impossible especially if you're thinking well actually all I have to hit is and I'm going to do five sets of three exercises that's not outrageous not at all so so like absolutely possible if you're wanting to go more towards 20 or getting closer to that 25 like now it starts to get pretty challenging so um scientifically the research will suggest

03:50:02 it's going to be equally effective practically it's challenging for people to hit sufficient volume without just being so demoralized afterwards because they're in so much pain they can't get out of their car cuz their legs are so trash they can't sit on the toilet get back up without crying um from pain so that's not good no that's not good I say that cuz those are actual examples that have happened in my life yeah I I realizing as we're having this conversation about ways to stimulate hypertrophy that I've sort of

03:50:29 defaulted to more intensity as opposed to volume because of the time factor I have a lot of other things going on in my life and So within that hour I Can't Get Enough sets in across all the muscle groups I need to hit and I'm only going to do it about once a week and so it's at least for me more advantageous to just train extremely hard I actually use the pre-exhaustion technique that you mentioned before yep or pref fatigue as you referred to it of hitting something really strong with an isolation exercise

03:50:55 then doing compound exercises I'm starting to think based on what you've told me that pre fatigue and then a compound exercise in some ways it's not really two sets because if you're going to failure for straps you're kind of pushing past failure then you're doing a compound exercise and you're doing that two or three times well that sounds like four to six sets but the force repetitions are almost like an additional set right and so it's not 20 sets but it's four to six really really hard sets that go beyond what we

03:51:29 normally think of as a set totally okay it's sort of the difference between running on concrete and running on Sand when I go for a sand run it's a very different experience totally yep and this is why uh I should have mentioned this at the very very beginning of our our chat today but all of these numbers that I'll give you for any exercise adaptation you you you cannot think of them as hard lines they are gradients and so when we think about the number for hypertrophy in terms of repetitions I said four to 30 what do you think

03:51:59 happens at three do you think hyper just stops right in fact the number you'll see in the literature is more like six to 30 I actually slide it down to four though like personal preference because of that but it just Fades away what do you think happens at rep 31 35 there's it just Fades gradually over over time so you actually sort of brought this up one of your earlier questions and I'm not sure if you were even thinking about this or maybe you were I just babbled on about something else but if strength

03:52:24 happens between this like one to five repetition range and hypertrophy typically happens in this like eight to 30 range what happens if I were to do to sets of six or God forbid seven like seven and nine are these numbers you just absolutely don't do in strength training right just like set of 1 2 3 4 5 6 got 8 10 12 like do not program a set of 13 when I'm training sets of seven to nine yeah it's great right uh we'll use sets of seven a lot um with weightlifters because you can actually count numbers more effectively B but

03:52:53 what happens in seven to n rep so this is actually wonderful area of these like five to eight repetitions where you're going to get a nice combination of a lot of strength gains and a lot of hypertrophy so someone who's coming in going man I want to get stronger and I want to add muscle what do I do here well that's actually a really nice answer train pretty hard in that like four to eight repetition range and you're going to get a lot stronger and you'll still induce a lot of hypertrophy if you want to really maximize

03:53:23 hypertrophy I would probably spend most of your time in the 8 to 15 repetition per set range you can go up to 30 admittedly though I don't think it's optimal to spend most of your time at more than 15 reps per set it's very challenging to maintain the focus required at rep 27 to actually get sufficient failure by rep you just you just give up way too early it's hard to do the same thing at the bottom end of that Spectrum in terms of of really heavy to get there so I really honestly think 8 to 15 is still it's cliche it's

03:53:56 that textbook number but it's a reason that's a textbook it is tried and true and very very effective if for instance you want to get stronger though and not invoke a lot of hypertrophy you have a couple of tricks you can pull number one stay south of that five repetition range you do sets of one sets of two go as heavy as you can um with all appropriate considerations and stick within maybe even up to three reps per set you start getting to four to five to six now you're going to start itching towards

03:54:26 that that hypertrophy range so stay down there do a lot more total sets so do a classic example would be something like eight sets of three right you're going to get a lot of practice you're going to get 24 very high quality reps with a lot of rest in between okay you go from there you go to managing caloric intake making sure your protein is still on point you want to recover but if

your total calories aren't um you know greater than 10 to 15% above your maintenance needs then you're not going

03:54:54 to be able to put on a whole bunch of muscle mass because you just don't have the fuel for it you can also then space your workouts out so that stimulus isn't coming uh extremely often so if you do that thing a couple of times a week it's not enough frequency in that signal so remember that signal has to be frequent or loud you didn't make it super loud and now you're not making it super frequent you can can get very very very strong like that and and put on very low amounts of hyper if that's sort of the

03:55:21 choice so you told us a lot about volume and frequency and how that relates to protein synthesis and Recovery to evoke the hypertrophy adaptation response how should people think about systemic damage and Recovery because obviously the nervous system and the way it interacts with the neuromuscular system is the sight of all the action here or at least a lot of the action and the nervous system can in fact become fatigued it's you know that has a great capacity but the whole system that we're talking about can be

03:55:55 worked to the extent that even if a muscle group like the biceps or the back is being allowed to rest while you're training legs and other muscle groups that your whole neuromuscular system needs rest how does one determine whether or not your entire body needs complete rest or or low-level active rest or exercise of a different kind yeah yeah sure so I want to actually tackle this because we're on the topic of hypertrophy I'm assuming that that's the goal in mind here yes here I'm asking specifically within the context

03:56:22 of hypertrophy I realized that for other training goals the answer to this question could be quite different yeah okay so we actually do this in a couple of different ways let's start local and work back to systemic right because um number one what you're really concerned about is at the local muscle level is am I going to create excessive damage uh and I don't necessarily mean muscle damage here I mean injury right so um the kind of rule thumb we use is is like three out of 10 in terms of soreness if

03:56:46 you're more than three out of 10 in terms of soreness we're going to start asking questions if you're higher than six out of 10 we're probably not training this is subjective measure total subjective measure right and you'll you'll know very quickly right if you're like if you can barely graze your PEC with your fingertip and then you're like ah I don't care what you score that we're not training there's just no damage if you're three out of 10 if you're just like oh I'm kind of like a little bit stiff here but once you get

03:57:11 warmed up you start feeling okay you're probably okay to proceed this so that is is a very easy way to just think about soreness you're going to be a little bit tight depending on your training frequency now zooming out to systemic we use a whole host of things so we actually have a a whole host of biomarkers we use you can get a lot of these from blood so you can look at things like creatine kinase that's the very common one marker of muscle damage um we'll actually look at um LDH we'll look

03:57:36 at myoglobin um that's just like if you think about hemoglobin is the um is the molecule that carries oxygen throughout your blood the myoglobin is the part of that that's actually in muscle so when muscle gets broken down that gets leaked out and put in your blood so that's one of the markers actually that's going to be associated with things like rabdo which is a like you're going to see your urine is purple it's extremely dark because you've got so much muscle breakdown that that happens and kidneys get have a problem

03:58:01 and you put a bunch of stuff in there so we use those biomarkers we'll actually also look at probably a couple things you're familiar with alt and um these are excellent biomarkers of muscle breakdown so if we are actually suspecting that this is a chronic problem um we're going to actually go and pull some blood um if it's just like I'm super sore today we're going to use that subjective marker but if we're seeing this as constant like man are we really pushing you way too much is there

03:58:23 some sort of systemic problem um we're going to blood and we're going to look at all those different things now as to alt is really specific and I don't want to take us too far off track here but the ratio to those things is actually very important as well so um if you look at the as to alt ratio typically the number we'll look at as like 1.67 as that ratio is like higher than that you have a pretty high risk of muscle damage but really between you know me and you and a few of these listeners anytime we start seeing

03:58:49 a outkick alt we're immediately thinking as in the ratio being higher than one um we're immediately thinking like there's something happening muscle damage wise so um that's actually a sneaky good indicator of just total muscle mass um because the vast majority of that's going to be in muscle so um those are actually some markers that we like a lot if muscle damage is uh the thing we're concerned with if we are more concerned with things like total training volume systemic overload then may turn to

03:59:15 something more like sleep there's a lot of information we can actually get glean from changes in sleep um behavior and function um you could also look at things like HRV heart rate variability which is a very classic marker and much more sensitive to changes with training than something like a resting heart rate um which is one thing you can actually do that's totally

cost free just look at your changes uh and any elevation resting heart rate over time especially more than three to five

03:59:41 consecutive days is an indicator but HRV is much more sensitive um to things like training induced overload so that's a quick version of stuff that we're going to pay attention to the last one I would add there is simply motivation so if you're really training hard and you like training hard and you just like cannot force yourself to go anymore that in of itself can be a good indication of it's maybe not the day maybe not the week um with all of these things you want to be careful about overreacting to a single

04:00:08 day measure again we look we need to look at at least a trend of more than 3 days honestly I'm looking at more than 5 days um I'm going to pull back from that and think about what phase of training we're in what part of the Year we're in typically other athletes we inseason pre-season postseason offseason Etc to make our decisions about what we're going to do about it are we canning the entire workout are we doing a modified lower version lower intensity um my default generally if hypertrophy is the

04:00:34 goal remember volume is the driver there so if I can like can we get in can we go real light let's go to six out of 10 rpe so relative perceived exertion um maybe we'll reduce the range of motion maybe we'll make it a little bit easier maybe go to machines or instead of going a squat we'll just do you know a leg extension something like that but I want to still get enough volume in there that will keep you on Target and and again even going at 50% not not to high repetition you know 50% for a set of 10

04:01:05 three sets just get a nice blood flow in there get it in get it out Aid and recovery and then move on and come back the next day that's probably what I would do rather than canning the entire ire session how do other forms of exercise combine with hypertrophy training for instance can I do cardiovascular training for two or three days per week provided that cardiovascular training is of low enough intensity and not disrupt hypertrophy progression and can I do that cardiovascular exercise before or after the hypertrophy

04:01:45 training or does it need to be separated out the answer to this is really what we call the crossover interference effect okay it's really an energy management issue so the only time endurance seor starts to interfere or block or hinder attenuate hypertrophy is in one of two broad categories number one total energy intake or your balance is off so you can amarate this by just eating more if you do that then the interference effect generally goes away the second one is you want to make sure you avoid exercise

04:02:16 forms for your endurance training that are the same working group and specifically the Eccentric portion so for example we see much more interference with running on leg hypertrophy than we do cycling right less Eccentric pounding and loading less damage less things to recover from the tissue seems to be totally fine the only other thing you need to worry about here is total volume of your endurance work so if you're doing a moderate intensity for a moderate duration say 70% of your maximum heart rate for 25 minutes it's

04:02:46 unlikely to do much damage in terms of blocking hypertrophy you're totally fine do you can you do it before or after your workout it's probably not going to matter that much right so prefatigue is okay for hypertrophy so if your prefatigue is coming from endurance then you're totally fine not a big deal afterwards cool you want to break it up into multiple sessions that's probably better right so if you do your endurance work on a separate day that's probably best case scenario if you can't do that

04:03:11 but you can break it up into two workouts say you lift in the morning and then you do your you quote unquote cardio at night maybe that's second best third best is doing it at the end of your lift and finishing it that's fine just make sure that you're maximizing your recovery on all the other tricks we'll talk about later make sure the calories are there make sure you're not doing a lot of Eccentric landing and that endurance stuff and you'll be just fine and where does higher intensity cardio fit into a hypertrophy program so high

04:03:38 higher intensity cardio uh for instance in my mind is getting on the assault bike and doing um you know eight intervals of 20 second Sprints and 10c rest in between or perhaps going to a field and doing some bounds and Sprints and things of that sort not going all out not you know running for one's life but getting up to about you know 85 90% of running for one's life sure so we have a lot less information on the potential interference or not of high intensity stuff um the stuff we do have suggested it may actually Aid in

04:04:12 hypertrophy and that's because if you think about it one of the potential paths to activation of muscle growth is this metabolic disturbance you're going to get that a lot with the the high intensity interval thing so it's not a terrible thing to do I wouldn't do it to the level that it compromises your ability to come back and do your primary training so if you're so fatigued your legs are super heavy they're depleted you now have to ingest extra carbohydrates to replenish muscle glycogen to be able to handle both

04:04:38 recovery and continue training Etc that could then lead to a problem but in general U really don't see any reason why that is going to completely block or or make it such that your training was quote unquote wasted or it didn't work in a fact actually um a very recent uh study came out where they uh had individuals perform six weeks of purely aerobic endurance steady

state long duration endurance for six weeks I think prior to starting a hypertrophy phase compared that to individuals who did not do that

04:05:10 and those folks that did these six weeks of just I think it was cycling actually just endurance work had more muscle growth at the end of their hypertrophy training than those folks that did not so this shows you very clearly there are a lot of advantages that come with being physically fit to Growing muscle so folks that also um have actually hit plateaus a lot one of the things you may actually see some benefit from is actually doing a little bit more endurance work whether it's a steady state stuff maybe it's the higher

04:05:38 intensity stuff um certainly if you're starting a training phase it's a pretty good idea to do that and there's a number of physiological reasons of why that's potentially occurring but the the lowest hanging fruit here is we sort of joke you know like if you're so unfit that you're tying your shoes and your warmup and you're already breaking a sweat you probably don't have enough Fitness to do enough training to get enough hyper so that is in fact your limiting factor you're not recovering

04:06:05 you're super fatigued and damaged and sore because you're so unfit so get fit first and then you can actually get more gains a week later so you have to kind of Kick the Can down the road for a few weeks but 10 weeks later you'll be in a better spot than you were by investing a little bit in your conditioning so as you pointed out before and I can only assume you were referring to me uh hypertrophy training is idiot proof uh meaning there's a lot of leeway in the variables but not so much leeway that

04:06:32 people can do anything it it's bounded by these general principles so with your permission I'm going to do a brief overview of my notes based on your description of the modifiable variables that will direct somebody towards hypertrophy keeping in mind this backdrop of exercise Choice exercise order selecting appropriate volume that sets and Reps training frequency and needing some Metric or way to have progression yeah either by adding more weight or by more tension or more metabolic stress and so on in terms

04:07:08 of exercise Choice it sounds like the choice of exercises is not super critical in terms of specificity yeah but that the ideal circumstance is that people are targeting all the major and frankly secondary and minor muscle groups if you can even call them that yeah across their exercise choices that they're picking exercises that they can perform safely and that they can generate enough intensity so that they're getting close to failure without placing themselves into danger right so um for some people that might mean

04:07:41 including large compound free weight exercises like wats and deadlifts and bent over barbell rows as well as isolation exercises and for some people there might be a bias toward more isolation exercises and machines but of course machines don't necessarily mean that you can't use heavy loads in fact plate loaded machines like Hammer Strength machines it will allow for quite substantial loads so picking two or three or more movements per muscle group can be valuable but that overall consistency is going to outshine

04:08:15 variation in the sense that you don't need to hit muscles with a different exercise every workout coming back to the same things has a benefit and we heard about this in our discussion around strength and power as well okay in terms of order of exercises there too it sounds like there's a lot of flexibility one could do the large compound exercise for let's say um quadriceps and hamstrings and glutes first like a a squat or a front squat or could deadlift for that matter but then if one deadlifted and primarily

04:08:47 hit the glutes and hamstrings then you might want to Target the quadriceps more directly with leg extensions or if one squatted and was loading the squat bar carrying the squat bar in a way that was predominantly quadricep yeah and lesso glute and hamstring then leg curls would be a good choice Etc okay and train your calves folks very important unless you're a genetic freak of course it's actually a good opportunity to say unless you're a genetic freak or you just have a genetic PR position yeah or

04:09:14 you've done Sports and and you have a genetic predisposition that gives you you know very large calvs that don't require any training at all I know people like this they're they're somewhat rare but they're out there yeah and those folks sometimes want to stay away from or minimize their training you told me that even if you have a muscle group that's a hyper responder in terms of hypertrophy getting at least one or two good hard sets per week is good because you want to keep functionality in that neuromuscular system love it

04:09:42 okay in terms of volume again we have a large amount of variation is what I'm hearing that the total number of sets per week is a strong driving force of program design and selection that ideally you're performing 10 to 20 and probably more like 15 to 20 sets per week and that could be divided up across multiple workouts or done in one workout but that's 10 to 20 sets per week per muscle group not really taking into account indirect activation so that would be 10 to 20 sets for biceps your back work is going to hit your biceps a

04:10:19 little bit maybe a bit more depending on the exercise selection but it's really 10 to 20 and given that hypertrophy can still occur and maybe even occurs better with more volume y then don't include the indirect work unless something about the architecture of your body and the inability to engage certain muscle groups like makes the a pull-up really an arm exercise for you do I

have that right the way that I would maybe planet is typically with movements we consider to be there to be primary movers

04:10:48 secondary movers and then tertiary movers right if it is a primary or secondary I'm probably counting it if it's tertiary or less I'm probably not counting it got it so going back to our example of a pull-up so an example of a pull-up I probably wouldn't count the biceps in a pull-up but I would probably count the biceps during a chin-up would you count the rear deltoid in a pull-up probably not may maybe like uh it just depends um probably not though okay train the rear delts also that's only honestly the reason I answered that is

04:11:17 because most people don't do anything for the real delts anyways but they should right absolutely that's why I didn't want to count it I wanted you to go out of your way to make sure you did something specifically for the real rear delts for Aesthetics and for functionality for health and and balance across the shoulder totally neck uh shoulder all of it I'm so happy to hear you say this I'm a huge fan of people doing rear deltoid work for all the reasons you described and neck work for that matter I think people forget that

04:11:42 the neck is the upper part of your spine yeah and for postural reasons and for stabilization and safety reasons it's really critical but I think most people aren't familiar with how best to train the rear deltoids and neck and I know a number of people are afraid of getting a big neck which for reasons that are still uh unclear to me is referred to as no neck but let's leave out that no neck comment for the moment what are some good exercises for targeting the rear deltoids and neck safely that people can

04:12:12 perform for stabilization and for hypertrophy yeah I would recommend people check out Eric Cressy he's a a wonderful uh strength conditioning coach he actually is I think the director of pitching for the New York Yankees now is that spelled c S s i e c r s y I believe and he's got a facility in uh I believe Boston as well as in Florida so he's very very involved in pitching as well as hockey and things like that so um he has so many free videos and resources on a on so much of the shoulder girdle

04:12:50 mostly because he he's dealt with overhead and throwing athletes and so the Precision required there is tremendous so you want to be very careful when you start playing in this area because the wrong positioning of your scapula can cause a whole bunch of problems in your neck and low back and so he would be a great resource to go take a look at that um depending on how your your scapula are gliding and sliding and the way that you want your rotator cups firing ing um your rhomboids there's it gets like very

04:13:16 complicated very quickly so you want to learn more go there as a very very quick couple of answers um one of my favorite exercises is is lying on a bench or or putting some bench and then just doing a reverse fly basically um the reason I like stabilizing the rest of the body is so you can make sure you can focus on just using those rear doids and putting your scapula in the right position now there's a there's a specific set of queuing that you want the scapula to move down and back for again check out

04:13:43 uh or any number of folks in that area to do it but that that's a very simple way the reverse fly to get there great and then in terms of neck exercises I was told to avoid Bridges because they can cause damage to the discs I will probably never do a bridge ever uh the rest of my life so um isometrics are are a great exercise for that because if you think about what uh what you're asking muscle groups to do in the neck you mostly want it to be able to do a certain type of rotation a little bit of

04:14:10 flex and extension um and some some other movements but in general it should be being stable um so you want to walk through these joints asking kind of what they do are they a moving joint or they a stability joint in this case you want to do there so isometrics are going to put you in a much better position there's some actually pretty cool devices that you can wear and you can put them on your head and you can do all kinds of movement um and get some great training there those are great starts

04:14:33 but if you don't have any of that just basic isometrics are a great way to go about it um neck Bridges would not be on that list for me no neck Bridges folks in terms terms of sets and repetitions we briefly touched on this but anywhere from probably six repetitions all the way up to 30 repetitions but probably more in the 8 to 15 repetition range for hypertrophy most of the time yeah and I'll just throw in there because I I love this idea that if you want to get a relatively balanced adaptation related

04:15:07 to strength and hypertrophy that 7 to n range that the No Man's uh or and no woman's uh land of of training repetitions I always joke in class I'm like okay we we go through the whole thing right you're like 1 to five strength 8 to 12 you know hypert Tre and they're like great and then I'm like okay so six to N means nothing will happen at all and the kids are just like writing it down like right good way to for everybody to remember that there are adaptations triggered in the six to9 rep range and

04:15:34 it's a balance of strength and height you'll just get thrown out of any gym that I'm a part of fantastic if you do that uh so but the important point is to get close to failure and occasionally hit failure maybe occasionally throw in a force repetition or a rest pause where you rest and then do a few more something like that but those intensity increasing Maneuvers will uh

require a little bit more attention to recovery either time or or attention in some other way and here's a little bit of carot all throuut

04:16:03 people because people generally don't like to be told to not go to failure that often right so so there's a handful of like half the folks are like sweet I don't have to train that hard to get there and those folks it's like well yes but I also said you just can't like do a half workout you have to get pretty darn close to failure and most people don't really know a failure means so for that group it's actually it's still probably harder than you think you want to train for the other group though that like

04:16:26 wants to completely blow themselves out every single time dragging them back is is more the key now for those folks here's what I can say if you make sure that your hidden stressors invisible stressors are completely taken care of you can go to failure a lot more often and so you need to dial those things in and then now you can go hammer yourself because you'll recover so much quicker and we see this very commonly um in all of our programs with with our athletes and and our non-athletes that when we

04:16:55 get that the rest of the Hidden invisible stressors taken care of their training volume goes up so much because they'll just start coming back and they're just like oh my God I'm not sore anymore oh my God I'm not nearly as sore I did this exact workout you know countless times before and now I'm doing it and I'm not sore at all anymore what the hell like we didn't do anything different with the programming or really the nutrition but we got the rest of that allostatic load under control and boom things take off it's a lot like

04:17:20 drivers so many people seem to be riding the brake and so many people seem to be heavy on the accelerator yeah that's actually one of the ways we describe it is like you want to go faster people's inclination step one is to hit the gas our our step number one is making sure your left foot's not on the brake you'll go faster with less resistance which means you'll actually wear down the system a lot slower by just taking your foot off the brake first if you're then not going fast enough enough now we can

04:17:43 push the accelerator but I'm not pushing that accelerator while your foot's still on the brake you're going to go a little bit faster but not as fast as you should be going with that much work and you're going to start wearing down brake pedals and things like that so I like that analogy so so hitting that 10 to 20 sets per week repetition range is pretty broad provided you get close to failure hit failure every once in a while could be the final set of each exercise or maybe do one workout where you hit

04:18:09 failure on everything but then you don't do it for a few more again there there sounds like there a lot of play in the system here rest ranges anywhere from 30 seconds all the way up to 3 or 4 minutes depending on how heavy you're training and how close to failure or to failure maybe even quote unquote Beyond failure if there is such a thing you're training um throwing in negatives and things like that we didn't get into really high-intensity techniques but people again vary in the extent to which

04:18:35 they're they're pushing the system but there does seem to be some value to mixing up the rest between set range across exercises and across workouts but you could combine them all in the same workout is what I heard yep and then in terms of progression it sounds to me like the goal in hypertrophy training is not necessarily to add more weight to the bar although that's one way one could do it but that the progression actually can arrive through this really extensive kit of changing the speed of

04:19:08 movement changing um the number of sets adding some volume um maybe changing the split so that you go from a 3-day Week full body workout to more of a um body parts one or two body parts per day every other day or two on one off at any number of different variations that are out there sounds like all of these can and will work provided that people are obeying the general principles of this uh hypertrophy adaptation inducing protocol that you described and that they are meeting the necessary but not

04:19:40 sufficient variables as well such as sleep yeah nutrition and managing the stress in the rest of their life do I have that correctly yeah that's really really good uh one more thing I'd like to add is this is a situation for hypertrophy in which there are some exercises that I actually don't think are good ideas so I want to make sure we we included those in the conversation um that's not necessarily a case for strength you can really do kind of whatever when you want and that is specifically Plyometrics although in

04:20:11 fact if you look at um there's a a recent review paper came out showing that like plan metrics are effective as well right sounds like one can do almost anything as long as it falls within this parameter set the concepts are few and the methods are many and the methods for hypertrophy are many many in general though Plyometrics are not my first second or even like 100th Choice um for hypertrophy they if they're a part of a total training program and you get some herper as a result cool you're lucky not

04:20:40 the first place I'm going the other major category are weight lifting variations so then when I'm saying weightlifting I mean specifically Olympic weightlifting as in Snatch clean and jerk and their variations those are just not a good exercise Choice it's not that they don't work it's just

the risk the benefit ratio starts to fall pretty fast in a in the negative favor and so it's just not worth doing sets of 10 of a snatch unless you're in a sport where that's like the competition or whatever

04:21:03 but if the goal is simply hypertrophy um choose different exercises than that great now I realized that we are going to do entire episodes related to nutrition supplementation recovery Etc but I'd like to just touch on two or three specific topics and questions that come up a lot around the question of hypertrophy specifically and that probably also relate to strength training and training for Speed so I'm going to ask these in um not rapid fire but I'll give you shorter answers so that way so I will ask these questions

04:21:38 now but with the caveat that we will get into these Topics in much more depth yeah very soon the first question is about the use of cold showers and Ice baths and cold water exposure which I know many people use for resilience training to increase their dopamine which it does and for recovery but there's also this issue of when one should use cold that is deliberate cold exposure relative to hypertrophy training specifically and that's because I've heard that if Del CBC cold exposure is done too soon after a hypertrophy

04:22:16 adaptation inducing workout yeah right all the sorts of things we've been talking about that the hypertrophy response can be blunted reduced or eliminated is that true and if so when could people do deliberate cold exposure while still also including hypertrophy training in their program and still get hypertrophy great so you know I'm a lover of the cold I I still have a deep freezer uh in my house that is filled with water at times that I plugged in and and is a frozen chamber I still do the old school style of it please unplug

04:22:47 it before you get in it each time oh yes absolutely and then don't do it by yourself so that the lid can close on top of you and then we don't see you sort of ever again Han the Han Solo effect it's time for me to upgrade and get one of these new fancy ones but I've been using this for so many years so I love it um obviously I've been involved with xpt and and Gabby and lar and and Brian McKenzie and these folks so I've been doing this stuff for a long time I've but I don't even know how many hundreds of folks into the ice and done

04:23:13 for a lot of reasons so there are a lot of benefits and we can talk about those later however that that being said it is very very true you do not want to get in the ice post hypertrophy training you wouldn't want to do that immediately after the workout you probably don't want to do it before the workout and you probably don't even want to do it that same day um it it's just not worth it it will blunt hypertrophy and specifically we've talked earlier about what's driving muscle growth is that signaling

04:23:37 Cascade uh through that gene expression through that muscle protein synthesis cold exposure blocks that signal remember adaptation comes from stress you've put in a stressin now you've blocked that stress you've literally block the signal that tells your body come back and grow larger size so not a good idea to do it if you're training for some other purposes maybe strength maybe there's an argument there although maybe not um for Speed and power maybe you can get away with it endurance maybe a separate conversation if you're in

04:24:09 season I have no problem using it immediately after a game the goal is entirely different even if we did a hypertrophy type of training program we're not doing it try to try to maximize growth in that particular case our priority for Recovery is higher than our priority for muscle growth so we choose optimization in that category you can only make those choices though when you truly understand what is the goal for the day the week the month the phase of training and really what part of the year you're in we have that all plotted

04:24:37 out for for all the people we work with so I know when we want to choose one over the other it's not a this is the choice you always make sit generation that's just not how we operate we need more Precision than that so that being said we're generally not going to do it if we want to do a lot of icing during a phase in which we're um using a lot of hypertrophy we're going to do a couple of things number one we may just not use it so there are phases in our training where I don't want to maximize recovery

04:25:03 I'm not going to give you any tricks here I'm not going to do ice or any of the other methods we're going to talk about why because the whole point is to cause overload that's what's going to be the stimuli to cause adaptation if all I'm doing is blocking that stuff attenuating it smashing it back down I'm undercutting myself I'm choosing to feel a little bit better to have a little bit better performance right now knowing that's going to compromise the results I'm going to get 6 8 10 12 weeks from

04:25:29 now right so I'm not going to choose it at all in the reality of it is if I really am trying to maximize hypertrophy I'm probably not doing any ice work during that whole phase maybe like my off day I know that's similar to a setup you have like one day a week when I'm not training we'll jump in some ice maybe even do some hot cold contrast um I I love the xpt protocol it's you know you've probably talked about it before that's a great setup um or or just not do it at all right it's just not something we need when we move into

04:25:57 another phase of training where we're trying to maximize adaptation or maximize the result and and get the benefit of that training now we're going to hedge more towards recovery and we're going to bring in some of these strategies and techniques and not worry about causing the most stimuli there because we're trying to a CU we're trying to actualize the work we did 6 8 10 12

weeks before what about cold showers do those have the same hypertrophy blunting effect as in general no in general you can do cold

04:26:24 showers that's not going to be a problem you're not going to be in there very long and you're not going to get nearly as cold um as you will submerge in 30° ice water for like that the way that we do it nonetheless so um I have no problem standing in the shower for a couple of minutes um using it for other reasons if if you want to that's no issue I'd like to talk a little a little bit about nutrition and supplementation as it relates to hypertrophy Dr Lane Norton who's been a guest on the hubman Lab podcast and we

04:26:52 both know throughout a number range related to protein intake on the backdrop of how much protein synthesis can occur by meal across the day Etc a lot of lot of research done there and some important work by him in particular and then the value that he threw out was 1.6 grams per kilogram of body weight being the lower end of the range up to I believe is it was as high as 2.4 maybe even as high as 2.7 yep grams of protein per kilogram of body weight per day that's a pretty broad range but it's on the higher end of what I think most

04:27:31 people think of in terms of protein intake and then again some people might already be right there or maybe even above that value of course this all depends on whether or not people are omnivore vegan uh meat-based Etc we won't even go there but assuming people are getting enough protein per day so somewhere in that range and they are spreading out that protein intake to accommodate the fact that the body can only assimilate a certain amount of protein in any given sitting what do you like to see people

04:28:02 ingest at some point post hypertrophy inducing workout in order to get the protein synthesis Advantage if you will yeah that is stimulated by that workout earlier you mentioned the you know the post training feeding window that you know in the 90s and probably earlier people were talking about oh you know within the first 90 minutes you have to get amount oh was it 30 minutes of uh excuse me a certain number of grams of carbohydrate and protein Etc I think now the understanding is that that window is

04:28:34 much broader MH um and uh how broad and Etc is is still a matter of debate but when somebody is trained specifically for hypertrophy assuming they are getting enough protein from quality sources in their other meals and assuming that their overall macronutrient intake and caloric intake is high enough that is they have enough of a caloric Surplus that they have the the raw materials for for hypertrophy what do you like to see people ingest at some point post-workout in order to facilitate muscle protein

04:29:08 synthesis and recovery and this could include nutrition and supplementation if you want to divide those answers out um feel free to do so of course yeah okay great so a ton of work came out of Don Layman's La was actually Lan's Mentor as well as Stu Phillips at McMaster so a ton of work there and we can answer a number of things here so Lane's numbers that he recommended uh also known as about a gram of protein per pound of body weight it's a great start now once you slide below that's per pound right

04:29:36 one gr per pound right and earlier we just to make sure because we're changing units here uh it was 1.6 gr per kilogram of body weight all the way up to I think it was 2.4 but maybe as high as 2.7 yeah um grams of protein per kilogram of body weight so 2.2 in that unit would be the same thing so 2.2 grams per kilogram is the same as one gram per pound right so depending on which where you're listening at to this at one of those may be easier than the other for you um if you start getting below that number now you do start

04:30:07 running into questions of protein quality protein type and protein timing this is one of the reasons why I fully agree with Lane is just get that number higher than you think and then all those other variables don't matter if that number is low then you need to start paying attention to a bunch of other stuff you've added now complexity to your program things you got to pay attention to just stay high and it it doesn't matter and so you can just leave a lot of those things off the table that seems to be fairly clear in in the work

04:30:33 of some of those gentlemen I just mentioned that as long as you get to that total number the question about timing and um types and quality it seems to matter a lot less in fact uh ste's recent work in non-animal-based proteins it really showed that to be fairly clear that those are quite effective assuming total protein intake is high enough um the amount of Lucine and other amino acids in those actual proteins matter less if the total threshold is just super high so just do that and you're fine um now the other caveat we have to

04:31:01 say here is timing of macronutrients is seems to be somewhat irrelevant for protein but that is not the case for carbohydrates so that timing does matter replenishment of muscle glycogen is very specific and you want to make sure that that is around a lot if you're doing either maintaining training quality or you're sliding into endurance type of work and so nutrient timing does matter with carbohydrates maybe less so with protein and certainly less so with protein if the total protein ingestion

04:31:29 is high enough so um it depends on what we're going after in terms of a training goal um and where we want to get with all these things in general the way that we like to think about this is if you're doing a strength type of work where you're truly targeting that then a one: one post exercise protein to carbohydrate ratio is generally what we're going to go after so this would be

something like 35 grams of protein 35 grams of carbohydrate it doesn't have to be post it can be pre or my favorite is

04:31:57 actually mid um or post but somewhere in that range especially if you're training in the morning and you have not consumed anything prior to your workout and that's not necessarily eating in the middle of the workout that's drinking calories yeah it's going to be I yet to see someone eating a sandwich on uh in the although I'm sure it's happened yeah so one to one is that like sort of standard number here um if you're going to do sort of more of a really hard conditioning workout that number slides

04:32:24 up to something like three or even four to one which would be carbohydrate to protein ratio so if we want to stay at 35 grams of protein we're going to go maybe as high as like 100 or 140 grams of carbohydrate again depending on what type of training we're sorted doing if you're going to do a little bit of a combination then you like a little bit of strength a little a little bit of conditioning and kind of a standard workout which is probably something that a lot of people will do then you maybe

04:32:46 want to go to something like 2 to one so you know 35 grams of protein 60 70 grams of carbohydrate and those are kind of just like rough numbers that you can go by and for Pure hypertrophy training would you like to see people ingest some carbohydrate post training for Pure hypertrophy training I want to see that as many of those nutrients around the training as generally possible now again I may change my mind when our fasting study comes out but as it stands now there is no advantage to not fueling

04:33:18 around the training and there are some known and some other potential advantages to fueling so I just see no reason to not do it um in fact most people are generally going to do better now this is not science this is just my coaching experience um and this is with our athletes and all of our non-athletes that we've worked with and do work with they're just going to be better spreading those meals out generally throughout the day and and they're going to be better if they have those nutrients either pre mid or post and so

04:33:47 they're going to get even for hypertrophy they're going to get something like that one 3 to one ratio of carbs to protein personal preference some people don't like to eat before they train some people have to eat before they train some people can't you know put in food in their belly immediately after work around that you can you can play based on personal preference but we want that fueling in there um because we want to maximize the potential growth and we want to just get a jump start on recovery because we're going to be

04:34:11 training again pretty soon supplementation is a huge topic and one that we will go into in great depth in a soon to occur episode but if you had to pick one supplement that can benefit most everybody if not everybody yeah for their training directed toward strength power and hypertrophy what would that supplement be and how would you like to see people use it meaning how much should they take and when should they take it sure if you don't count protein and carbohydrates as supplements they technically are but we'll just walk out

04:34:47 of that right sorry I I should be more specific I'm not referring to uh nonfood form um protein and carbohydrate so powdered protein and pow powdered carbohydrate Etc um technically are supplements they're highly processed but they're um but I'm not including that I'm I'm referring to um non- macronutrient type supplements yeah does testosterone count um well in the context of this discussion it's testosterone that people are manufacturing themselves ah okay the cheating kind the endogenous kind no um

04:35:18 I mean is the answer here without question it is the most well studied it is the most effective and its uh benefits are robust meaning they're going to confer positive adaptations across multiple physiological domains so we could certainly have a very long chat about some of the interesting things that people in fact we just had um Darren kandal um on on our barble shrug podcast and he went into extensive detail about all the benefits of creatin that people have no idea about including things like bone mineral density you

04:35:50 asked about that earlier creatin is actually fairly effective for that um let alone the thing uh the benefit in things like cognitive function decision- making memory um the work that there being done there for neurological disorders um depression a whole host of things that that creatine is being studied for some uh of those studies show a lot of benefit some of it show maybe a little bit some none but there's just a lot of things creatine can do um so when we could talk about Muscle Recovery or muscle hypertrophy um that's

04:36:21 where the bulk of the research is and and it and it's very effective um in terms of type creatin monohydrate is still the best one and that's just because it has the largest evidence base um you can maybe make some arguments for some other types but you're really going to reach saturation pretty quickly within a matter of weeks and there um at a dosage of anywhere between like 3 to six grams per day um now five grams is the very standard number we give reality is I change that number based on size

04:36:50 that's just the honest truth um if you're 225 PBS you're not going to get the same dosage of creatin as 125 pound girl that's just just like this is not what we're going to do so we may slide that number down a little bit closer to three for the the smaller girl boy doesn't matter it's just Fe physical size if you're one of our 275 or 330 lb offensive right tackles in the NFL you're not going

to get the same dosage as everybody else so that number is going to go up to seven 8 n maybe even 10 grams a day there so that's just

04:37:17 kind of the scale in general if you wanted an easy answer for five grams is the standard taken after training the timing doesn't matter totally irrelevant take it in the morning breakfast take it at night take it anytime you want take it pre um we tend to put it in a lot of people's um workout um shakes just to make sure they get it in throughout the day but the timing is irrelevant great well thank you for that very informative answer and I look forward to much more discussion about nutrition and

04:37:42 supplementation and recovery and all the rest in the episodes to come this was incredibly informative thank you so very much I appreciate the opportunity uh I had a great time doing that I I love talking about these things I also really like talking about uh what we're going to get into in our next conversation which is the physiology of endurance metabolism and fat loss if you're learning from Andor enjoying this podcast please subscribe to our YouTube channel that's a terrific zero cost way to support us in addition please pleas

04:38:12 subscribe to the podcast on Spotify and apple and on both Spotify and apple you can leave us up to a festar review if you have questions for us or comments or suggestions about topics you'd like us to cover or guests you'd like me to include on the hubman Lab podcast please put those in the comment section on YouTube we do read all the comments please also check out the sponsors mentioned at the beginning and during today's episode that's the best way to support this podcast I'd also like to inform you about the hubman Lab podcast

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04:39:05 also go into the menu tab and go to newsletter and see some example newsletters from months past thank you once again for joining me for today's discussion about fitness exercise and performance with Dr Andy Galpin and as always thank you for your interest in science [Music]

00:00:00 welcome to the huberman Lab podcast where we discuss science and science-based tools for everyday [Music] life I'm Andrew huberman and I'm a professor of neurobiology and Ophthalmology at Stanford school of medicine today my guest is Dr Sarah gotfried Dr Sarah gotfried is an obstetrician gynecologist who did her undergraduate training in bioengineering at the University of Washington in Seattle she then completed her medical training at Harvard Medical School and she currently is a clinical Prof

00:00:30 professor of Integrative Medicine and nutritional Sciences at Thomas Jefferson University she has also been a clinician treating men and women in various aspects of Hormone Health and Longevity for more than 20 years she is an expert in not just traditional medicine as it relates to hormones and fertility but also nutritional practices supplementation and behavioral practices and combining all of that expertise in order to help women navigate every aspect and dimension of their hormones longevity and vitality ranging from

00:01:01 puberty to Young adulthood adulthood perimenopause and menopause and nowadays she's also treating men across the lifespan in terms of longevity vitality and Hormone Health during today's discussion Dr gried shares an enormous amount of information and tools that women can apply toward their Hormone Health fertility vitality and Longevity we discussed the gut microbiome which many people have heard about but Dr Godfrey points out the specific needs that women have in terms of managing their gut microbiome and the ways that

00:01:31 that influences things like estrogen levels and Metabolism testosterone thyroid and growth hormone and much more we also discuss nutrition and exercise we touch on how the omega-3 fatty acids play a particularly important role in managing female hormone Health Dr gried points out why women have particular needs when it comes to essential fatty acids and how best to obtain those essential fatty acids for Hormone Health we also discuss exercise and she offers some surprising information about the

00:02:00 types ratios of resistance training to cardiovascular training that women ought to use in order to maximize their Hormone Health we also talk a lot about the digestive system this was a surprising aspect of the conversation I did not anticipate Dr gried shared with us for instance that women suffer from digestive issues at more than 10 times the frequency that do men and fortunately that there are tools specific to women that they can use in order to overcome those digestive issues and that in overcoming those digestive

00:02:27 issues they can overcome many of the related hormone issues that so many women face Dr gried also shares with you tremendous knowledge about the specific types of tests not just blood tests but also urine and microbiome tests that women can use in order to really get a clear understanding of their hormone status not just of present but also where the trajectory of their

hormones is taking them so we have an avid discussion about puberty about young adulthood adulthood per menopause and how best to manage and navigate per

00:02:58 menopause and menopause including a discussion about hormone replacement therapy in addition to her academic and clinical expertise Dr gotfried has authored many important books on nutrition hormones and supplementation as it relates to women and to people generally the two books that I'd like to highlight and that we' provided links to in the show note captions are women food and hormones and the hormone cure I read the hormone cure and found it to be tremendously interesting and informative

00:03:24 not just in terms of teaching me about female hormone health and various treatments for female hormone Health but also as a man trying to understand how the endocrine system interacts with mindset nutrition and supplementation more generally so I highly recommend the hormone cure for anybody interested in hormones and Hormone Health and women food and hormones in particular for women although again both books are going to be strongly informative for women wishing to optimize their Hormone Health vitality and Longevity before we

00:03:51 begin I'd like to emphasize that this podcast is separate for my teaching and research roles at Stanford it is however part of my desire and effort to bring zero cost to consumer information about science and science related tools to the general public in keeping with that theme I'd like to thank the sponsors of today's podcast our first sponsor is Roa Roa makes eyeglasses and sunglasses that are of the absolute highest quality I've spent a lifetime working on the biology of the visual system and I can tell you

00:04:17 that your visual system has to contend with an enormous number of challenges in order for you to be able to see clearly so for instance when you go from a very brightly lit area to a dim lit area your visual system has to make all sorts of adjustments that allow you to still see your environment Roa eyeglasses and sunglasses were built with the biology of the visual system in mind so no matter what environment you're in you'll be able to see with perfect clarity and they have terrific Aesthetics and

00:04:41 enormous number of choices in terms of Aesthetics so unlike a lot of so-call performance eyeglasses out there that only give you the option to wear the ones that make you look like a cyborg they have those options but they also have a lot of options with Aesthetics that you would be perfectly comfortable wearing to work or to dinner or anywhere else if you'd like to try Roa glasses you can go to roka.com that's r.com and enter the code huberman to save 20% off your first order again that's r.com and enter the code huberman at

00:05:09 checkout today's episode is also brought To Us by thesis thesis makes custom neut tropics and as many of you know I'm not a fan of the word neut tropics because neut Tropics means smart drugs and as a neuroscientist I can tell you there is no neural circuit in the brain for being smart thesis understands this and has designed different neut Tropics in order to bring your brain into specific States for specific types of work so for instance for Creative work or to engage with more Focus or to give you more

00:05:36 energy for cognitive or physical work so with thesis they'll design custom neut Tropics for you that will allow you more focus better task switching more creativity and so on and they'll be sure to include only the ingredients that you want and not the ingredients that you don't I've been using thesis for more than a year now and I can confidently say that their neut Tropics have been a total GameChanger for me I like the clarity formula prior to Long bouts of cognitive work or the energy formula

00:06:00 prior to physical workouts if you'd like to try your own personalized neut Tropic starter kit go online to take thesis. huberman you'll take a brief three-minute quiz and thesis will send you four different formulas to try in your first month again that's take thesis. huberman and use the code hubber minute checkout for 10% off your first box today's episode is also brought To Us by element element is an electrolyte drink that has everything you need and nothing you don't that means the exact ratios of electrolytes are an element

00:06:29 and those are sod magnesium and potassium but it has no sugar I've talked many times before on this podcast about the key role of hydration and electrolytes for nerve cell function neuron function as well as the function of all the cells and all the tissues and organ systems of the body if we have sodium magnesium and potassium present in the proper ratios all of those cells function properly and all our bodily systems can be optimized if the electrolytes are not present and if hydration is low we simply can't think

00:07:00 as well as we would otherwise our mood is off hormone systems go off our ability to get into physical action to engage in endurance and strength and all sorts of other things is diminished so with element you can make sure that you're staying on top of your hydration and that you're getting the proper ratios of electrolytes if you'd like to try element you can go to drink element that's Int.com huberman and you'll get a free element sample pack with your purchase they're all delicious so again if you want to try element you can go to

00:07:26 element lm.com huberman the huberman Lab podcast is now partnered with momentous supplements to find the supplements we discuss on the hubman Lab podcast you can

go to live momentous spelled o us liv.com huberman and I should just mention that the library of those supplements is constantly expanding again that's liv.com huberman and now for my discussion with Dr Sarah gotfried Dr gotfried Sarah welcome thank you so happy to be here yeah I'm delighted and very excited to ask you about an enormous number of

00:07:57 topics you are expert in so so many things so uh the challenge for me is going to be to uh constrain this walk as it were but uh I'm hoping that we can touch on a great number of things today the first of which is really about hormones and female hormones in particular and I have a question which is is it ever informative for a woman regardless of age to know something about her mother's perhaps even her grandmother's experience VIs V hormones not just pregnancy challenges with or um ease with pregnancy and child rearing

00:08:38 child birth this sort of thing but you know what sorts of conversations should women be having with themselves and with family members to get a window into what their specific needs might be love this question so my work is really at interface between genetics and environment so your question gets to both and I think it's essential that you understand what your grandmother went through I'd even say your great-grandmother depending on longevity in your family so I grew up with my great-grandmother I get that and

00:09:13 especially your mother so I would probably start first with trauma an intergenerational trauma because I think that affects the endocrine system so hugely especially cortisol signaling but the broader Pine system Psycho imuno neuroendocrine System and then there's you know if I think about the stages the life cycle that a woman goes through if you think about puberty I think I don't know how genetically determined the age of puberty is certainly there's a lot of environmental influences like toxins can affect it but

00:09:55 um pregnancy the age at which you start to go through per menopause menopause many of those have a genetic component so with pregnancy I mean you can certainly think the shape of the pelvis your ability to have a vaginal birth some of that is genetically determined I mean you do have you know the the sperm donor affecting some of that but you know in my family for instance we have no cesarian sections so everyone goes through this process of a relatively easy national birth I was a forceps baby

00:10:32 but you know for the most part um you can find out about that and then there's certain female conditions that have a very strong component genetically most of which run in my family so that includes enmet trios fibroids I just had a hysterectomy I had a 50 plus fibroids and uh polycystic ovarian syndrome and of those three uh how fre are those and um maybe I can constrain the question a little bit by saying um today's discussion I imagine is going to be heard by men and women of all sorts of Ages so I um maybe I'll direct the

00:11:09 question a little bit toward you know at what age should these discussions start um you know we always imagine that uh women in their um 30s and 40s and 50s and onward should be getting certain tests and um addressing things like uh ovarian reserve and and other sorts of things but you know maybe we could March through and just say for a woman in her teens who's already hit puberty what sorts of biomarkers whether not their blood-based or per or um phenotyping you know the outward appearance of uh should

00:11:45 those young women be paying attention to likewise for women in their 20s 30s maybe we could take it a more or less by decade at starting at puberty assuming that woman hits puberty sometime what between what is it now the average in the US is somewhere between 12 and 16 years years old do I have that right no you do not oh great I love to be wrong so so it used to be 12 to 16 I would say 50 years ago it's been moving younger and we think some of that is related to toxin exposure as I mentioned but I was 10

00:12:18 when I went through puberty so uh well I should say menarche and I started growing breasts much before that so I think now I'm going to step away from the science for a moment I'm going to do that pretty fluidly and I'll try to call it out I think there's also a huge influence from stress and like the development of the adrenal glands so going back to the science the issue in teenage years is that the hypothalamic pituitary adrenal axis and I like to think of it broader so stay with me I hypothalamic pituitary

00:13:00 adrenal gatal over recent women testes and Men thyroid gut axis so that to me is the control system so I'm kind of expressing my bioengineering side here well I think it's great to include the other organs and tissue systems of the body because as we both know that the narrow definition of just hypothalamic pituitary adrenal it can't be just that right no it can't right no yeah it doesn't tell the whole story so if you look at the the main sex hormones in a a young woman who's in her teenage years

00:13:38 the hypothalamic pituitary adrenal part of that is not fully mature so they're more likely to skip periods especially under stress they have a lot of influences that really doesn't get well established until you're done with adolescence and I'm told that adolescence now is till like age 25 to 26 I heard that I was like I've got two daughters and I was thinking that's a really long time not just psychologically defined or bio psych mostly mostly psychologically defined I heard that from a psychologist

00:14:14 so biomarkers you asked about in your teenage years what I think is really interesting is to look at cortisol to look at the dance between estrogen and progesterone in those years is less

helpful because I think there's a lot of variability due to the immaturity of the system if you've got someone who's got really regular periods it's probably better to do some benchmarking at that age but generally I find that benchmarking is best performed in your 20s or 30s are periods not that regular in terms of duration of the menstrual

00:14:49 cycle when the menstrual cycle first sets in it depends so I was like clockwork every 28 days until I had my hysterectomy in August same thing with my daughters I've got two daughters one's 17 the other's 23 for a lot of women they're not regular and then there's the whole piece of oral contraceptives and other forms of contraception where you have no idea what the normal cycle is and I hope we'll have some time to talk a little bit about oral contraceptives because I think it is this is now opinion again

00:15:25 and not science I think it is the number one endocrinopathy that is iatrogenic for women uh we will definitely talk about I get a lot of questions about oral contraceptives um in the social media space and also questions about iuds quite a lot totally in particular copper iuds non non-hormonal iuds so we will definitely touch on that I'm an IUD Crusader so I just want to you know give you that warning you're you're a fan do I have that right or you're anti I'm a huge fan uhuh which iuds in particular so I like

00:16:00 copper because it's non hormonal it's as effective as getting your tubes tied who would have thought it's that toxic to the sperm Mobility is that how it works that's my understanding of it is that that it basically it's like a uh more or less an electric fence to the the sperm cap and just that's it electric fence is a bit of a harsh analogy but I'll work with that but it's you know to have something that can last for 10 years so that you really have complete autonomy and sovereignty over

00:16:33 your sexual life that's profound and to not get all those Downstream risks that are associated with birth control pill the other thing that's important to know about it I know this is a zore women who use the copper IUD have the highest satisfaction rate of anyone on contraceptives the highest satisfaction rate and yet it is the least used of all forms of interception now my favorite is vasectomy but short of vasectomy I think the IID is a really great choice there are some risks associated with it I'm

00:17:08 not saying it's risk-free but I love the ID and I love it for younger women too because it used to be that when I went through my training which was 30 years ago we were told you know don't put it in someone who hasn't had a baby and that is patriarchal messaging but getting back to your original question which is about biomark per decade in your 20s that's when you want to do some base casing with estrogen progesterone and testosterone so I think it's really helpful to know about this this Tango

00:17:44 you're from Argentina or your father I have Argentine lineage yes yeah my grandparents did Tango into their late 80s I I am I'm in my late 40s and I I still haven't started so I suppose there's time it might be time for you to that okay and it might be a factor in their longevity do they have good health span not justan and my grandfather Smoked Cigarettes daily remained mentally sharp until he died in his late 90s but um almost burned down their apartment several times falling asleep with a cigarette in his mouth so I don't

00:18:16 recommend anyone Smoke by the way uh but it was uh coffee mate red meat and cigarettes and they lived into their 90s so that side of my family has the genetic Advantage the other side less so um but in any event um Tango um is a is a 2023 goal it has been every year um the uh I'm gonna hold you accountable to that okay we'll do and there no there will be no YouTube video of me doing thing at least not initially Tim Ferris actually a phenomenal podcaster as we know is a he's a badass he's a badass

00:18:47 Tango Tango dancer I know this through various sources yes yeah I've seen yeah so this Tango between estrogen and progesterone is incredibly important you want to have the the right lead you want to have the right follow between the two hormones again I'm stepping away from my science hat but what happens a lot of the time is that estrogen dominates in that Tango and when that happens it sets you up for a greater risk of fibroids enetri posis breast pain probably in association with the microbiome in the estrobolome oh can you

00:19:25 familiarize me with the estrobolome I'm delighted know that I don't recognize the term yeah so the estrobolome is the set of microbes in and their DNA their DNA mostly in the gut microbiome that set of microbes in their DNA so it's in the if you look at the totality the subset of particular bacteria modulate estrogen levels so a lot of this work was spearheaded by Martin Blazer and what we know is that there are some women who have an estrobolome that makes them have a greater risk of certain estrogen

00:20:11 mediated conditions like breast cancer and amral cancer and in men prostate cancer so the estrom is incredibly important there's not a lot of attention paid to it but I always think in terms of my patients you know could this be someone who's got faulty estrobolome and we need to adjust it with you know some of the microbiome uh modulating uh nutrients nutrical that we have so that they're less likely to have that that Tango that's not working with estrogen and progesterone so getting back to the

00:20:50 biomarkers if if you gave me an unlimited budget which I kind of have with some of my um clients that I work with now what I would want to know is estrogen progesterone

testosterone and I want the timing right for that I'd want to know about DHEA and sort of the whole Androgen pathway I'd want to know about the metabolites of estrogen because some of them are protective and very helpful others are a bit like Homer Simpson I mean they are just like causing all kinds of problems in your body increasing the risk of Quinones like d

00:21:29 damage and potentially an increased risk of breast cancer although that data I think is mixed I'd also like to know about their stool so I want to know about the microbiome so the best that we have right now is to look uh when we do stool testing and I do a lot of stool testing we can look at things like beta glucuronidase are you familiar with BG I'm familiar with it as a term and so for those listening it very often not always when you hear an acea you're dealing with an enzyme so we can take a

00:22:02 stab there and and it sounds like it's somehow involved in um glucose metabolism of some sort or is it glucuronidation so it's involved in when you produce estrogen in the body this is like the simplified version but when you produce estrogen you are meant to use it like send it to The receptors where it's meant to go and then lose it like you don't want to keep recirculating estrogen like Bad Karma and that's what happens with people who have high bet beta glucuronidase so it's this enzyme that's produced by three

00:22:37 bacteria in particular in the gut and I see a lot of men and women who have elevated beta glucuronidase and then they have some estrogen dominance related to that is that the total reason we don't really know but it's one of the drivers it's one of the levers and it can be detected from a microbiome AK stool sample that's right and terms of blood testing or various tests for these other biomarkers getting estrogen testosterone and other ratios I I realize there are people have different means financial means but in general

00:23:10 people wanting to do a blood test it sounds like they're going to need to do it what women will need to do it at different stages of their menstrual cycle if they had to pick one you know either in the follicular phase and or in the lunal stage of their ovarian menstrual cycle excuse me ovulatory menstrual cycle when would you suggest they do that if they had to pick one so if you forced me to pick one I would say probably day 21 to 22 for someone in her 20s so we're focused right now on that decade so for most women they've got a

00:23:44 menstrual cycle date that averages out at 28 days so this is about a week before they start their period for women who are more regular it's harder to do that as women get older and we'll talk about this in a moment usually the the cycle gets a little shorter so as they start to decline in their progesterone production their period gets a little closer together like mine before August was about every 26 days so at that point you want to test sooner like day 19 20 and I'm not talking about a blood test so a blood test is the

00:24:18 cheapest thing it's usually what's covered by insurance but my preference would be to do dried urine I like to use saliva for cortisol I like to use dried urine so that I get metabolomics in addition to the levels of these hormones and if I'm forced to I'll use blood testing and that's certainly the gold standard for all of these hormones that we're talking about but um it's not as comprehensive and as you know it's a quick little snapshot while the needle's in your vein for you know 30 seconds yeah the

00:24:50 salivary cortisol makes sense to me because my understanding is that you get free cortisol which is the active cortisol you said with urine you're also getting the metabolites that's right and then um for blood testing you're getting sort of a crude window into the averages a static total level so uh let me go back and say one other thing about biomarkers a big part of the testing that I do in phenotyping my patients I practice Precision medicine so I like to almost start with nutritional testing I don't think I've ever had a

00:25:26 teenager I've got some NBA players that are 19 20 21 so maybe those count but uh those are men obviously but for nutritional testing that would be potentially a helpful thing to do in your 20s becomes less important as you get older and you develop more micronutrient deficiencies but micronutrients play a huge role in terms of hormone production magnesium you know the Magnesium is hugely involved in the way that you get rid of estrogen as an example so micronutrient testing what I usually do is a

00:26:00 combination of blood and urine and so I'm looking at all of the micronutrients that we can measure that have some clinical scientific basis behind them if I could do that for a teenager I think it might be helpful because I recently gave a lecture on breast cancer RIS reduction another quick sidebar and I was sad to find that intake of vegetables polyphenols is such an important predictor of future risk of breast cancer like when you're 50 60 plus and the most important time is when you're a teenager now I have one

00:26:43 daughter that eats vegetables she loves them and I have another daughter who eats food that's beige and it's very hard to get her to eat the volume of vegetables you know five colors a day which is what I do and if you have evidence that you could show a 17-year-old that they've got micronutrient gaps I think that would be a motivator for them to eat differently at a time when it's so critical even though it's you know 25 years in the future that it's going to potentially change this Arc that they're

00:27:18 on what do you do for a young woman who doesn't like vegetables is or is not somehow able or willing to to get those five colors a day of vegetable to help support the

microbiome you know are supplements a useful tool in that case um what other sorts of tools Behavioral or otherwise are useful such a good question so here I'm going to invoke Rob Knight at UCSD so I think his his gut project has really been helpful in terms of understanding what kind of modulators are going to be important so what I try to get that

00:27:57 person to do and I don't see many teens anymore other than NBA players what I try to get them to do is to have a smoothie very hard to get them to have a smoothie every day but if I could get them to have a smoothie three times a week and to throw some of these vegetables in that makes a huge difference I mean we know that makes a difference in terms of microbiome change she be blending up broccoli or kale cauliflower so cauliflower great even they're putting things into the Smoothie yeah I don't know if you can get a

00:28:25 teenager to do that but they often will use like I have them do steamed broccoli that's in the freezer because it's got very little taste so that they could do that in a chocolate smoothie they could add some greens I like greens powders are was super convenient so that with you know kind of a a taste that they like whether that's chocolate which is what most of my clients want or you know vanilla with berries and that sort of thing so that can go a long way if you don't like vegetables and short of that

00:28:55 I would say some supplements but I would say that's a distant second to making a smoothie I've got one patient that I have to mention because um he took this to the extreme so he's a retired physicist professor at UCSD he found out that his microbiome was a hot mess and um developed autoimmune disease and so he became hellbent like only a physicist could on changing his microbiome and he dramatically shifted it by having a smoothie every day with 57 vegetables and fruits in it 57 independent 57 independent so I mean

00:29:41 this just warms my heart the way that he did this but he would go to the farmers market he would just get a bunch of this a bunch of that and he would go home make the smoothie and then stick it in the freezer so he'd have a serving every day and he became a completely different person based on this microbiome change his uh autoimmune disease is in remission he um he dropped a huge amount of weight he went from being you know kind of this phenotype that I know you know well of a professor High performing

00:30:17 traveling around the world on so many boards so much Innovation so many great ideas super computer guy to being someone who gets up in the morning gets in his hot tub EX exercises for like 1 to two hours a day and then does a little work like he completely shifted the way that he lives and his microbiome shift you know who knows what what's the chicken and what the what's the egg there but he had a huge change in his physiology glucose went from being quite high he had and he tracks all of this of

00:30:48 course it's like on S after all right and retired I suppose might have had and he's retired but he's he's got the Longest Time series of anyone I know and he's tracked his glucose and Insulin going back 20 years so he can show you okay here's where I started having my smoothie and here's how my glucose and Insulin changed as a result of that I'd like to take a quick break and acknowledge one of our sponsors athletic greens athletic greens now called ag1 is a vitamin mineral probiotic drink that

00:31:22 covers all of your foundational nutritional needs I've been taking athletic green since 2012 so I'm delighted that they're sponsoring the podcast the reason I started taking athletic greens and the reason I still take athletic greens once or usually twice a day is that it gets to me the probiotics that I need for gut health our gut is very important it's populated by gut microbiota that communicate with the brain the immune system and basically all the biological systems of our body to strongly impact our

00:31:49 immediate and long-term health and those probiotics and athletic greens are optimal and vital for microbiotic health in addition athletic greens contains a number of adaptogens vitamins and minerals that make sure that all of my foundational nutritional needs are met and it tastes great if you'd like to try athletic greens you can go to athleticgreens.com huberman and they'll give you five free travel packs that make it really easy to mix up athletic greens while you're on the road in the car on the plane Etc and

00:32:17 they'll give you a year supply of vitamin D3 K2 again that's athleticgreens.com huberman to get the five free travel packs and the year supply of vitamin D3 K2 is there a case for I'll say young women but young women and men um using over-the-counter probiotics as a way to enhance the microbiome this is something I hear about a lot I've heard that excessive doses of capsule probiotics can give a brain fog like condition um I personally don't use capsule probiotics unless I feel like my system is under a significant amount of

00:32:49 stress in which case I might add that in for brief periods of time or if I've just taken antibiotics for a period of time right uh do you ever recommend that the college student or the high school student that she or he take capsule probiotics assuming that they're getting let's say three to five servings of vegetables per day either in smoothie form or some other form what are your thoughts on on supplementing probiotics it sounds like such a simple question it is such a complex answer and I don't think we really have the answer

00:33:21 so I'll tell you the way that I approach it I look for randomized trials to support my use of probiotics and frankly I'm underwhelmed so I've seen some data if I invoke my um NBA

players for a moment almost every player I've tested has increased intestinal permeability they just have such a high training load probably mediated by cortisol very high glucoses when they drain that they have increased intestinal permeability so those tight junctions in their intestine become loose they develop a lot of

00:33:55 inflammation as a result of that and when you're a professional NBA player and you're making 20 million a year like you don't want a lot of inflammation you want a little bit to like help your muscles recover but you don't want it to be um adding to problems when you develop an injury so this is leaky gut leaky gut I don't love that term but yeah we'll use it here so there's a there's a particular probiotic that is helpful in athletes with leaky gut so that's the kind of specificity and randomized trial that I'm looking for

00:34:28 the rest of it I think there's support if you find help from it as you described if you take a course of antibiotics I mean first of all I would question whether you need them but I try and avoid them there there have been instances where they've been prescribed and I took them mostly in the past I was in college they seem like they kind of gave them out you had a sinus infection they give you you know antibiotics you like yeah the worst treatment ever yeah so if you're coming off of antibiotics I think that's a good

00:34:55 time to do what we call replacement dose Probiotics I think what's far more interesting is prebiotics I think the data is much better for prebiotics and um The Selective use of polyphenols how would a person in their teens and 20s or any age for that matter know what whether or not they have nutritional deficiencies what is the best way to analyze if one is getting enough magnesium um and for that matter what is going to be the best way to test the microbiome you said stool sample it and I'll come right back with the same

00:35:33 question I asked about blood test what time of day when during the month um to establish this a baseline so this would be prior to embarking on a you know 97 vegetables or how per day it's only 57 well I love the idea that you're telling us if I'm gathering correctly is that yes there's a case for probiotics but for the typical person regardless of age eating more vegetables or drinking more vegetables as as the case may be is going to be beneficial for the gut microbiome perhaps without the need to go test whether or not one

00:36:05 is making a certain number of estrogen related metabolites or not just that that's a great starting Place eat or consume more vegetables totally um but if one wants to analyze their gut microbiome are there good tests available to the general public this has been I'm not going to name companies but I've been tracking this over the years and it's never been clear to me that we know what constituents of the gut microbiome are are best you we know that dis is is bad and we know that diversity of the microbiome is good we hear this

00:36:33 but no one's ever told me that you want a particular ratio of one microbiota to another right in a way that has made any sense to me at least totally um I'm not a microbiologist but whereas with you know with testosterone and Men we hear okay you want your free testosterone to be about 2% of your total perhaps with women you women are going to have more testosterone than estrogen on average but still less than men when you look at testosterone it's ET Etc but you can kind and get some some crude measures

00:37:00 but for the microbiome it just seems like long lists of microbiota for which um I just get dizzy I just if you just wrote out a bunch of I's and L's and s's you'd kind halfway you getting a bit bit the same information I'm not trying to poke at that field it's a beautiful field but they haven't told me what to what I what my microbiota ought to look like like what's a healthy microbiome chart well that's because we don't know I mean the best we have is Rob nights work but even even that is limited in terms of you know can I tell

00:37:31 you that a a woman in her 20s should have this particular pattern with her microbiome no I can't so um let me go to your first question because I think you just asked about six your first question is about nutritional testing what I like to do with nutritional testing is run a panel that's looking at antioxidants so like vitamin A vitamin C Alpha lip IC acid um plant-based antioxidants CU you can measure that in the blood I like to look at some of the key vitamins especially the B vitamin range because

00:38:09 as you probably know if you've got particular genetic um polymorphisms you might be less likely to be absorbing the right level of vitamin B9 folate vitamin B12 Etc um I'm also looking going back to the antioxidants at glutathione because I think that's such an important lever when it comes to detoxification which we haven't talked about yet and then I'm looking at some of the Minerals Magnesium is really the most important and we know that somewhere around 70 to 80% of Americans are deficient in

00:38:39 magnesium that's like the the lowest hanging fruit I would be curious for instance like with magnesium if that number of people are deficient does that mean that that number of people should be targeting their nutrition towards foods that contain magnesium and or supplementing with magnesium and if so what forms of magnesium we've talked about mag 3 and eight SLE there's a magit there's so many forms can be a little bit of overwhelming to people so any any detail um in sourcing would appreciate it great so first in terms of

00:39:07 testing what I prefer to do is to mention one more than one lab and more than one brand um and I can just I'm speaking mostly from experience so uh for testing I do a lot of goova

neutrals during the pandemic they developed an at home tests normally with a neutral you have to get your blood drawn and you have to do a urine sample so a lot of people can't do that the great thing about this test is your insurance usually pays for most of it and so the co-pay is about \$150 so during the pandemic they

00:39:43 developed another test called metabolomics which does much of the same testing but it's a finger prick so most of my patients prefer that in fact they haven't gone back to the neutral second lab is Spectra cell I use Spectra cell occasionally I find it not quite as easy in terms of fitting into my practice but I've got friends and mentors like Mark Houston who does a lot of uh kind of precision um cardi metabolic Health he thinks spectrol is the best test out there so you asked about magnesium you have to measure red blood

00:40:22 cell magnesium like whole blood and with deficiency it's interesting with supplementation for my patients who tend toward constipation and that's frankly about 80% of the women that I take care of really yes wow I'd be curious as to why that that is um is it I I can guess uh diet stress um patriarchy rage so psychos psych so Pine the um the pine system right psych psych olog Immunology neural and endocrine factors combined is it yes and then I would say there's another factor which is being female is a health

00:41:11 hazard so we've twice the rate of depression insomnia we've got 3 to 4X increased risk of multiple sclerosis we've got 5 to 8 times the risk of thyroid dysfunction so if you just look at that and you look at subtle preclinical thyroid dysfunction a huge number of the women that I take care of well let me back off a large number of the women that I take care of have thyroid dysfunction that's contributing to constipation and if we go back to that control system the hypothalamic pituitary adrenal thyroid gatal gut

00:41:48 AIS and they have a lot of perceived stress together with this borderline thyroid function that no mainstream medicine doctor has told her is a problem and then she's got a problem with the Tango between estrogen and progesterone she's going to tend toward constipation women have a lot more constipation than men the gut is about 10t longer in women compared to men we should talk about some sex and gender differences and Define those sure and they are much more likely to have a torturous colon and the way you know

00:42:22 that is you get a colonoscopy and they tell you yeah it's really hard to like get in there do what we need to do as a brief tangent but I think this is the time to ask um what at what age now do Physicians insists their female patients get colonoscopies uh for men I think the age used to be 50 now it's getting ratcheted back to 45 or 40 again these are recommendations not requirements but they're pretty strong recommendations from depending on where you live Etc um for women how early do you think they

00:42:54 should get a colonoscopy to to explore for possible pops Andor colon cancer yeah it's a really good question I don't know the answer so what I've always operated with is 50 the way that I answer that is to go to the US preventive task force rating to determine based on their synthesis of the data what age is the most appropriate has it changed as you just described for men from 50 to younger I don't know so we should fact check that all these um additional health hazards for women um you mentioned some some of

00:43:27 the you broadly mentioned psychological impact right and and of course these things are all related psychology immunology and one of the I think wonderful things about neuroscience and Science in general and medicine is that there's now an an understanding that all the organs are connected to one another it's a network it's a network and then the microbiome sits at at um at a key node within that Network um and I think most people accept that now yes you it that seems to be a theme that at least

00:43:57 in the last 10 years is really wonderful because um certainly for Neuroscience it was thought that you know unless it's in the cranial Vault it's not neural which is ridiculous because there's lots of nervous system outside the the skull but in any case for can I interrupt for a second yes please so I think you're right that there's an understanding about the network effect but I think that as much as I love mainstream medicine and I trained in it and I so grateful for my education I still think

00:44:26 it is a silo based way of taking care of patients so even if there's an understanding of the network effect more at the science level or as you described in Neuroscience there's still you know if you are a woman who has constipation fatigue um maybe an autoimmune condition uh feel stressed out all the time feel like your hormones are out of whack you get sent to the gastroenterologist for the constipation you get sent to the room dermatologist for your autoimmune issues you maybe get sent to an endocrinologist if you've got

00:45:03 thyroid problems and there's very little collaboration between these groups so even though there's an understanding of the network effect in real life it's not happening let's um let's go deeper down that path because I you point out something really important and and you've mentioned constipation a few times can we view constipation as a serious enough symptom that it warrants an immediate intervention that is does it flag or signal problems that are severe enough that that should be the issue that's

00:45:35 dealt with uh for anybody that's experiencing it and I mean sort of an odd topic for many people because they think oh you know bowel movements and sort of you know there's that

kind of um pre-adolescent humor around this but I think it's it's so important what you're what I'm hearing you say is that constipation is far more common in women and it signals a general set many problems occurring does that mean that women should address constipation and if so what's the best way to address constipation yeah I love this question

00:46:03 because you're doing can we have a quick little meta conversation so you're doing something that I knew you would do which is you're teaching me something and you're changing like there's this social genomics thing happening where you're changing my thought about this so I just wanted to acknowledge that thank you thank you well I think for me you know when I hear that there's a kind of you know you're talking about a phenotype constipation is a phenotype it's one that people generally don't wear a

00:46:28 t-shirt explaining it to people but that I'm guessing anything to do with sexual health um bowel Health Urology people just don't talk about right um for all sorts of reasons and those reasons are probably so obvious that they're not even worth discussing but because and also because we won't change them except by talking about them y so if you say um women are far more constipated and that's signaling a larger set of problems yes then my immediate thought is well we relieving constipation um pun uh intended

00:47:01 retroactively um will that assist in a great number of issues Andor will it get them down the road of thinking about those other issues more specifically like do I need more magnesium or should I be putting vegetables in my smoothie you know so I'm curious about constipation as a Target yeah for intervention that then opens up a bunch of other discussions because there are these certain nodes in the in the mental health physical health space that when someone like we talk a lot deliberate cold exposure do I think it's magic no

00:47:31 but I think that if someone's getting themselves into a cold shower once a day it opens up a number of questions about themselves and reveals a number of things to themselves like how do I buffer stress yeah what sorts of levels of control do I actually have and on and on so perhaps not the best example but um some of us hate cold exposure right which is we have we have like a gene that makes us stress out like you wouldn't believe C exposure which I would argue makes it um very likely that even 10 seconds of cold exposure gets

00:47:58 you the effect that you want as opposed to someone who adores cold exposure like a penguin needs a lot more cold exposure for it to have the the Adaptive response anyway that's my way of of guming through that uh quite you're you're you're quite correct um so so let's answer this question constipation issue yeah so this is how you're changing the way I think about this so you're asking okay instead of looking at constipation as a constellation of symptoms what about if you just used it on its own

00:48:27 sort of a um a key indicator or signal of dysfunction with pine Network or maybe something broader and I think that's right so it makes me think of a few things it makes me you're also changing this book that I'm writing on autoimmunity and Trauma so thank you for that so women experience more trauma than men this is well established if you look at the ace studies that were done by the CDC and Kaiser in 1998 we know that men for the most part middle-aged men have about um about 50% of them experience

00:49:08 significant trauma as defined by the ace questionnaire women are at 60% and that's pretty durable since 1998 so women have more they have different forms of abuse much more likely to have sexual abuse they have a different HPA response than men men their perceived stress tends to be higher and I'm generalizing for a population so I note you know in Precision medicine we don't do that we do medicine for the indiv individual not the population not medicine for the average and so if you look at the

00:49:45 physiology of a female I think that um constipation and that need to like control and restrain and hold things in you know tighten the anal sphincter I think that's part of the physiology so I'm veering away from the science but I do think that it is a really important signal to pay a lot of attention to now you also asked about microbiome testing should we do that or do you yeah well I have one I have a couple more questions about constipation I never thought I'd ask this many questions about constipation but now I'm fascinated by

00:50:18 the way also this morning I taught medical students at Stanford about the fact that we are basically a series of tubes so you talked about the the anal sphincter we are a set of sphincters from one end to the other I mean we are tubes nervous system being one of those tubes and and I think in eastern medicine they talk about the various locks between those tubes and Chambers and it's not without coincidence there's some real wisdom there of course wait did you just talk about energetic Anatomy uh more or less I didn't say the

00:50:42 word chakras but uh I might in passing it's the bondas the bondas right are the are the are the the sphincters right yes that's right uh thank you for for that the um so what defines constipation I mean in other words let's let's think about that healthy rather than thinking about the unhealthy let's how many bowel movements should um a woman or a man have per day assuming this is where it gets tricky because some people are doing time restricted feeding some people are eating more some people

00:51:10 eating more fiber more bulk larger meal at the end of the day larger at the beginning of the day we will never um be able to sort out all those variables but on average um how many

bowel movements and is timing during the day for bowel movements at all uh informative well works for you um well when I'm asleep um generally I don't want a bowel movement so I'm going to be like most people right well sleep is primary for you right exactly um I'm I always assumed that morning time was a was a healthy

00:51:41 time for B movements um and I think almost everybody babies included recognize the feeling of being lighter and more energetic when they've evacuated their colon totally um in fact so much so that I'm I'm obsessed with jungian and fian psychology that the first thing we learn when we come into this world right is that we want something we we feel some sort of autonomic arousal stress whether or not it's food or warmth or the need to have a bowel movement one of the first things that parents learn is how to recognize

00:52:12 that not by the odor coming from the diaper but by the look on the baby's face or their agitation agitation signals the need for some sort of relief right temperature relief food relief um evacuating the bowel relief so my understanding is that as autonomic arousal increases in the early part of the day ideally after a good night's sleep that bowel movements become more likely unless that arousal becomes so great that then people feel so quote unquote locked up right um because of the the balance of the autonomic uh

00:52:41 features so early day I'm guessing and again in the second half of the day and here I'm totally guessing um and certainly not having to wake in the middle of the night um yeah those are my best guesses that's great so I would agree with that when I was at Harvard Medical School in UCSF or residency I was taught that constipation is having a bell movement less frequently than one every once every three days sorry I don't think I've ever laughed out loud on this podcast as a consequence of of uh textbook medical

00:53:14 knowledge are you kidding me is that ridiculous well that sounds like and and here pun intended that sounds like the uh the conclusion of some very um cons emotionally and and and and in other ways con cated individuals and again this might seem like an odd conversation but the the discussion around constipation is is present in psychological literature yes because of this relationship to the autonomic system well it's a metaphor in literature it's crucial so you you spoke to a number of different threads that I think are

00:53:46 important here so that's the definition that I learned and I was I heard that and I was like hell no that doesn't work for me doesn't work for anyone I know and I spent a lot of time time especially in medical school and in my internship where you rotate on medicine disimpacting women like older women who come in who haven't had a bowel movement in a month whoa and that let me tell you that is not nice for anybody well believe me I I became a scientist and not a physician for a number of reasons

00:54:17 that's one both positive and negative that's one of them yeah so my definition of constipation as a western mostly White girl is that if you're not having a bowel movement every single morning and you have a feeling of complete evacuation anything less than that is constipation so that's how I Define it if you're in India and you're eating food that's got a fair amount of microbes in it it's less you know sanitary I'm using that word um as carefully as I can generally they have about movement after every meal but

00:54:59 they've got a different microbiome they're exposed to different microbes here in the US I would say one day you also spoke to something very important which is the balance between the parasympathetic nervous system rest and digest and poop versus the sympathetic nervous system kind of the on button you know fight flight freeze spawn so I think for those of us who've got issues with autonomic balance it can lead to constipation and I like that constipation could be pulled out and kind of RIT larger as an

00:55:39 important signal what sorts of tools do you recommend people use to um relieve constipation um in eating more fiber sounds like reducing stress is going to be a huge one yes what are your favorite stress reduction tools um I like to divide these into um realtime tools so big proponent of like physiological s real time you know these sorts of things but um things that can really lower the Baseline on stress overall to facilitate constipation and other other um broad indicators of health so I'm not a fan of lowering

00:56:20 stress I'm a fan of lowering perceived stress and I think the distinction is really important I learned when I was in my 30s that I was a massive stress case and I didn't know it it was just sort of I think I through residency through working 120 hours a week I just was so accustomed and sort of um that was 120 not under 20 folks yeah not unusual in in medicine well they they've changed training so that you work no more than 80 hours a week now but that was before my time so I became accustomed to a massive amount of

00:57:05 cortisol massive and I would say I've spent the past 20 years really working on perceived stress to find I think all of us need an all a cart menu of what is most effective so what works for me now at my age is different than you know the the TM I did as a college student trans Dental meditation it's different than the I became a certified yoga teacher when I was in my 30s that is very effective for a lot of people it wasn't enough for my Matrix I do holotropic breath work um I didn't read it but I saw that

00:57:42 she just had a paper in cell on your sign and um it kind of it made me think like teach me how to sigh teach teach me how to sigh like can you say a little bit about that like how do you do

it yeah very briefly that study was we we wanted to find a minimal effective dose intervention yeah I just wanted yeah so five minutes a day we need to figure out what people would do every day yeah and we were monitoring subjective mood Etc but also Biometrics remotely so it's kind of a nice study which Biometrics

00:58:11 HRV HRV uh nighttime sleep cortisol uh I wish um so this was done during the pandemic more than 100 subjects the advantage was that we got data 24 hours a day because they're pinging us in their data uh wearing 24 yeah nice so that was nice resting heart rate um subjective mood we would get in touch with them daily so when people were swapped between groups like any good study but five minutes a day of sort of standard if you will forgive me meditations so just sitting no instructions about how to breathe just

00:58:43 focusing on um closing their eyes and focusing on focusing yep um another group did box breathing y inhale hold exhale hold for equal durations the duration of each of those inhales and holds was set by their carbon dioxide tolerance so somewhere between 3 and 8 seconds depending on how well they regulate carbon dioxide another group did cyclic sighing so this would be double inhale through the nose so big inhale through the nose followed by it to lungs empty exhale that second inhale after the

00:59:20 first big lung inhale through the nose is really important because it makes sure that all the collapsed avoli the lungs totally snap open and then the exhale you offload a lot of carbon dioxide that's very similar to holotropic breath work not yes not not um not unlike holotropic breath work little bit pranayama is um but the exhale is rather passive as opposed to active um and then the fourth category was cyclic hyperventilation which is a lot like Tumo AKA Wim hofish breathing different than Wim Hoff breathing so

00:59:50 this would be so very active inhales and exhales every 25 Cycles of inhale exhale that would be one cycle long exhale hold lungs empty 15 to 30 seconds then repeat for about five minutes everyone did that for five minutes and what we found was that the cyclic sighing led to the greatest improvements in mood Around the Clock not just around the the practice or during the practice as well as lowered resting heart rate improvements in sleep Etc and you got to publish in cell we were very fortunate I I think um

01:00:25 the the thankfully the reviewers and editors understood that these minimal intervention things uh hopefully are going to be of use to people so so useful to people I mean how often do you read a paper like that that could offer a behavior change that is so easy to implement I mean I love that question thank you so what about did you tell them not to drink because alcohol has such a huge effect on H yeah so in this case we didn't tell them to alter anything else about their behavior hoping it background kind of across the same Al

01:00:59 yes and some were Stanford students others were from the general population any Frat Boys we drinking heavily probably not well during the pandemic I think alcohol intake went way way up across the board um I mean is an if I had a magic wand I would I would ask that people either not drink or drink two drinks per week maximum at least that's my understanding of the literature um are you familiar with the whoop data with alcohol no but we have a collaboration with whoop through that paper um and it certainly disrupts

01:01:28 patterns of nighttime sleep in particular my understanding that first phase of sleep that's related to the massive growth hormone release that you we all really need and want in their measure growth hormone we did not no the second iteration of the study will certainly include free cortisol by saliva hormone panels well I'm beginning to think that we should also um be asking people how often they're going to the bathroom in what time of day yes I mean this thing around constipation is uh is super interesting and I think that

01:01:55 plus um BL blood markers and then I'm I'm very excited to learn that um that urine contains additional markers that could be informative so yeah it was a it was a fun study uh not easy study to do with that number of subjects um takes a lot of training for your research assistance yeah it was a big group it was nine people in our group and three clinicians and a lot of lot of phone calls and a lot of back and forth but you know and thank you to the subjects who served as the uh the real life

01:02:22 guinea pigs so yeah I think that stress you know people's I think people are starting to appreciate that there are ways that they can relieve their stress that that don't all only fall under the categories of vacation right and meditation but I want to say that meditation is obviously a wonderful tool um it's just it's a it's a tool not unlike any other tool that is great for some people and less great for others well certainly it's a great tool and it's got such a scientific basis behind it but there's so many things on this

01:02:51 allart menu sex orgasm um connect ction feeling heard and seen and loved um yeah let's talk about that you know you mentioned earlier that all these stress factors you you said patriarchy right but I think what if I may um at risk of uh of just strengthening that uh statement I I mean that that to me it's is signaling a bunch of other factors around as you said like keeping keeping things in um what do you think explains let's talk about that because I think that that's likely to have raised a certain flag in people's minds like

01:03:29 what exactly is she talking about are you talking about less opportunity are you talking about less opportunity to um to vocalize are you talking about less opportunity to vocalize

and be heard I mean I realize that there are an infinite number of variables but given that it sounds like a a really strong input to the system uh what I mean by that is that psychology is influencing biology and you're saying that that these uh that these power Dynamics structures and Dynamics are impacting I'd love let's hear your

01:04:00 thoughts on that because uh I hate to let a flag like that go by without fleshing it out and let never waste a good flag well and let's preface it by just saying that like people will have different opinions on this and that's and I think that's healthy and and like with the discussion about constipation let's talk about what people aren't willing to talk about when it comes to health love it so we might need to talk about patriarchy on part two but I'll give you some material that I've been working with

01:04:27 I started I did not even understand the existence of patriarchy until I was a bio-engineering undergraduate at MIT I should mention which has always had a bit of a male um a skewed male in terms of faulty numbers well my that's true at most universities true well my postto adviser was the late Ben Baris who was a female toale transition transgender first transgender member of the National Academy of Sciences one of my closest friends unfortunately died of of pancreatic cancer we were very very

01:04:58 close they're actually making a documentary about Ben but Ben this is interesting Ben went to MIT because he wanted to be around a lot of men yeah that's a lesser known fact but then he was a very strong advocate for women he went as Barbara when he was Barbara and um by the way he's given me permission to share all this prior to his death I recorded a lot of conversations with Ben um I only ever knew him as Ben by the way but when he was at MIT he was identified female and he later talked about the

01:05:32 intense um suppression oppression literally is how he described it um especially given that he was performing so well yes so you just defined patriarchy you did it yourself a couple things when I was in bioengineering I took a women's studies class and it was all about teaching under graduates about the existence of patriarchy which I would Define maybe at its simplest as power over I'm not saying men are patriarchy I'm saying something very different which is power over let me correct one thing that you

01:06:13 said I didn't go to MIT as an undergraduate so I'm from I was in Alaska and I went to the University of Washington for bioengineering in Seattle in Seattle okay I dropped out of a graduate program in bioengineering to go to the Harvard MIT program for Health Sciences and technology in Boston thanks for that clarification University of Washington also wonderful place I have many many many many wonderful close colleagues there it's an incredible place especially for vision science it's especially good for engineering

01:06:49 bioengineering but um yeah so my my MD is jointly between MIT and Harvard and it's the oldest maybe largest although Harvard says this a lot program for biomedical engineers and uh MD phds physician scientist training program great thanks for that clarification I'm going to blame the internet for this one I am I think we need to send our our Wikipedia editors out I I think LinkedIn is correct okay great well w wikipedia uh editors note get out there and make the make the correction now you heard it um so stress that is what

01:07:30 you're really talking about is systemic stress in the body as a concept as a consequence excuse me of systemic stress of environment that's right but there's you know there's particular forms of it I would say this also relates to White Privilege it relates to uh racism and when you look at you know kind of the way that systems including my beloved MIT the way that they're set up is that might Mak makes right and generally the people that are the strongest you know big men strong men they're the ones who

01:08:06 tend to be the most successful so for people who are bipo for people who don't have white privilege for women it's a different experience and so I'm using patriarchy as kind of a umbrella here but it connects to many other things I'd like to take AEF brief break and thank our sponsor insid tracker inside tracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in

01:08:39 getting regular blood work done for the simple reason that many of the factors that impact your immediate and long-term Health can only be analyzed from a quality blood test the problem with a lot of blood and DNA tests out there however is that you get data back about metabolic factors lipids and hormones and so forth but you don't know what to do with those data inside tracker solves that problem and makes it very easy for you to understand what sorts of nutritional behavioral maybe even supplementation based interventions you

01:09:06 might want to take on in order to adjust the numbers of those metabolic factors hormones lipids and other things that impact your immediate and long-term Health to bring those numbers into the ranges that are appropriate and indeed optimal for you if you'd like to try insid tracker you can visit insid tracker.com huberman and get 20% off any of insid tracker's plans that insidetracker docomond to get 20% off I want to use this as an opportunity to a keep this in mind as we turn to a question that I

01:09:36 didn't uh close the hatch on earlier and it's my fault which is I'm now clear on the fact that a woman in her late teens early 20s ought to know something about her testosterone

estrogen thyroid cortisol levels should start at least thinking about her microbiome should be thinking about how many bowel movements and the timing of those bowel movements per day really and I'm assuming that what I just described is also true for women in their 20s 30s 40s 50s on up to hundreds is that correct that's correct but I

01:10:12 would say that there [Music] are differential opportunities by decade so I'm glad she circled it back to teenagers and testosterone because I think if you know for instance in your teenage years that you have high androgens and that you've got this potential phenotype way into the future that you may not even notice I mean maybe you notice you've got a few extra hairs on your chin or something if you know that your testosterone is elevated or some other Androgen it might change the Arc of how you take care of yourself

01:10:49 so I think that could be very helpful in your teenage years in your 20s for people who are a stress case like me so age 27 on the words at UCSF if I had known that I was such a high cortisol person I think I would have done things differently I would have changed my behavior and I don't know because I didn't base case these but your testosterone can decline starting in your 20s kind of depending on how much stress your Matrix is under so for women that can start as early as 28 usually you're testosterone declines by about 1%

01:11:28 per year what level of testosterone do you like to see in a woman once she's sort of post let's say after age 25 what kind of range is healthy I know what the reference range is only because I know one could look it up I don't know it off the top of my head admittedly but what what's a kind of a nice reference point there so the way I tend to describe this on podcast is the top half of the normal range great so that I think is a good benchmark you know for PCOS generally it's much higher than that you know I've seen patients with

01:12:02 PCOS where their total testosterone is 100 to 200 do they always have peripheral manifestations of that a little bit of hair the the skin plaques I've heard about you know so dark and skin plaque regular periods regular periods is that um you know I I get a lot of questions about PCOS yeah um and you're the first person we've had on this podcast that's really qualified to talk about PCOS in a real way um so here we're talking about too many androgens cysts on the ovary irregular ovarian me uh excuse me I keep saying that

01:12:33 ovulatory menstrual cycle um what are some other indicators and do you recommend that women start taking Androgen blockers or or I mean how do seems to be a lot of PCOS out there I'm hearing about it a lot so glad you asked about this so PCOS is one of those really poorly understood conditions that gets it kind of flows flies below the radar until a woman wants to get pregnant or she's got some other issue that drives her to a physician the problem is that it is a syndrome right so polycystic ovary

01:13:11 syndrome sometimes polycystic ovarian syndrome and syndromes don't necessarily fit together into a really clear diagnostic criteria so in this instance there are three different criteria that we look for so cists on the ovaries having um clinical manifestations of hyperandrogenism so that could be hirsutism acne other things and then usually irregular periods and the way that that's defined at least by the uh latest criteria is having a period every 35 days or less so typical cycle length 28 days 35 days you know you're skipping

01:13:52 a period here and there so those are the those are the criteria that we use to diagnose PCOS there are about four different systems out there in the literature for diagnosing PCOS which is where it starts to get confusing so there's some women who have nodules on their ovaries but they've got hirsutism and they've got irregular periods could you define hirsutism is increased hair growth usually in places that you don't want it so for women it can be you know kind of male pattern they might notice it on their

01:14:23 breasts on their chest um um and then there's of course a a familial quality to that like I was just looking at a paper last night looking at ises and how much hirsutism they have and whether this is related to CAG repeats on the Androgen receptor do they get um not Israelis but um do women who um who might have PCOS experience um endogenous alopecia so hair loss that sort of of the quote unquote male pattern baldness of course it's Androgen pattern baldness as opposed to male we're talking about testosterone DHD related sometimes you

01:14:59 know this is where I'm going to invoke clinical experience rather than uh what I've seen in the literature women definitely can have some androgenic um alpecia I tend to see it later in life but this is an important point because we think of PCOS as you know I was just talking about it in teenage years like wouldn't it be nice to know that you have this phenotype and you're at risk for all the things that people are at risk for and we haven't talked about glucose and insulin yet we should what we know is that PCOS is not

01:15:31 just a problem in terms of irregular periods and then difficulty getting pregnant so those are mostly problems in your 20s 30s early 40s but it is a massive risk factor for cardiometabolic disease as you get older so many people tend to pigeon hole PCOS as a problem of reproductive age we have to be thinking of it over the entire female life cycle and I would say it's even more important to consider it over the age of 50 you know average age of menopause is 51 to 52 because we know that that elevated testosterone the high

01:16:09 androgens are probably the greatest cardio metabolic driver of disease for women with PCOS wow now one other thing I want to mention and I still have my notes that we're going to

talk about microbiome testing because that's such a fun subject what I was taught to do again saying this with so much love for the people who have taught me how to do medicine what I was taught to do is that if you have a woman with PCOS you make the diagnosis you measure her testosterone you see if she has acne blah blah

01:16:41 blah you asked that woman one question do you want to get pregnant or not so then you have these women with PCS who get started on a birth control pill if they don't want to get pregnant if they want get pregnant then you help them get pregnant by addressing some of these PCS issues like maybe you give them Clomid or you do something to make them ovulate more frequently that is the way that most conventional medicine approaches this and it does women at gigantic disservice so one of the things I'm speaking into

01:17:13 is the gender gap that exists so I my feeling is that the research money that goes into women's health is abysmal compared to what goes into Men's Health really and I think that's changing but there's also a huge lack of awareness of sex and gender differences when it comes to the way that we construct clinical trials and other experiments well that's absolutely true I mean I sit on I've sat on NIH review panels for more than a decade now I'm a regular standing member which is only to say that I see the research as it's

01:17:45 being proposed yes and now it's required no Grant will get funded without sex as a biological variable and here I'm I'm by the way folks this is sex biological sex the noun not sex the verb both are super interesting obviously but um when we say sex as a biological variable meaning even even if it's a study on mice where did that start though that didn't start that long ago it must have been I think we can thank I don't want to misattribute here I think we can thank Francis Collins for insisting on

01:18:14 this amen Francis and Bernardine hey Bernardine Healey has done so much to help us but you know she made the Women's Health Initiative which I hope we'll get to which just a hot mess like so confusing the data that came out of that and these trials are long and so the data are only now starting to emerge so just to be clear I mean I have a a question that I don't think is going to take us off track but this is I'm going to posee this question as a hypothesis because I think it's likely to be uh a

01:18:41 little bit of a of a not a barbed wire question but maybe like a prickly question when people first hear it but it's posed as a hypothesis you you mentioned some of the psychosocial stress issues based on at the organizational level institutional level societal level maybe right down to the family and and just life that are biasing Health outcomes for the worse in female populations okay you refer to as the patriarchy I'm just trying to put make sure that we're both talking about the same thing and that's non-exhaustive

01:19:13 I realize that's just a subset of the issues I'm also hearing there's a lot more PCOS which is hyper androgenization of the ovary in there we're talking about you mentioned you know excess testosterone which females naturally have more testosterone than they do estrogen anyway but we're talking about elevated levels here's a hypothesis one hypothesis would be that the increased androgens and the P PCOS are a consequence of the psychosocial conditions that are I don't want to say forcing but are biasing the need for

01:19:52 females to um think behav react act in certain ways to survive let alone Thrive is that a I don't say this for any kind of political correctness hypothesis this is a in my this would be a fun interesting and I think important study to run right depending on stress and the conditions the specific type of stress do females underproduce or overproduce androgens or is it a neutral effect does that make make sense I love this question so let me just paraphrase the last part of it to make sure I got it it sounds like what you're

01:20:32 asking is could PCOS or at least some phenotypes of PCOS be a response to what I'm calling patriarchy and then you had a second part to it which is do healthy women like what is their production of testosterone like is that right yes and and with the acknowledgement I mean you're the expert here um you're the physician clinician and expert in hormones and I'm not but with the understanding that absolute levels of hormones are interesting but perhaps not as interesting as the ratios of testosterone to estrogen so when we're

01:21:06 talking about excess testosterone we're really not talking about oh women making a lot of testosterone because frankly they already make a lot like then most people weren't aware of that I wasn't aware that women make more testosterone than estrogen right and so it's not saying that testosterone in women is bad or is always a reaction to the environment yes but when it becomes um super physiological or hyper elevated is I could imagine all sorts of social conditions that would create that um so

01:21:35 in males and females but here we're talking about PCOS and females in particular so I'd love for you to speculate um should we run the study we should totally run the study because I don't know the answer I suspect that you're on to something it may not explain all of the women with PCOS because as I mention there's a lot of different phenotypes but I think it could explain a significant portion and you know you're almost you're saying if we look at the gene environment interface this environmental

01:22:08 influence of having being someone who's got power over you if if PCOS was a response to that the way that we treat it would be completely different so on the one hand I want to

be careful not to dismiss the suffering and experience of women with PCOS I've got a lot of women with PCOS in my family and it is there's so much pain and suffering you know especially if you want to have a baby and you try for years and you just can't ovulate on the other hand I read a paper recently and maybe we could site this that compares the

01:22:52 phenotype of a woman with pcus to a man who is hypoandrogenic and I think that's a really interesting way to look at this because the thread we haven't talked about with PCOS is the the role of insulin and glucose so for some of the phenotypes of PCOS the problem is hyper insulin emia High insulin in the blood is driving those Thea cells in the ovaries to overproduce testosterone these women are insulin sensitive so more insulin is being cranked out and the cells in the ovary are therefore making more Androgen

01:23:32 you don't like to say insulin resistant oh I I can uh I don't have a problem saying resistance like the way I'm just I'm just a little bit outside the lane lines of my expertise so I I was trying to use it what what is the correct gnom en clature so that we can make sure everyone well what I like about insulin insensitive the way that you just said it is that I think that offers people a way in and I love to do that in terms of messaging insulin resistance starts to lose people cuz they don't really get

01:23:56 what that means at a receptor level I think I say insulin insensitive because when people hear insulin sensitive it almost sounds like a bad thing but that's actually what you want so I think I think that's how I defaulted to insulin insens what your insulin I don't know what I'm do for a blood test yes you are I'm doe for a blood test um I had blood work done about eight months um sure that'd be great I I uh I'm always um experimenting with different supplements and different behavioral regimens and I've kept charts since I

01:24:23 was 19 oh like my patient I been sort of Obsessed by this and I would say everybody if you can afford it and at the time actually I had to save up Insurance wouldn't cover it um get some basic blood work done so that you have a reference point do it as soon as possible because even you know the we've been talking about these women over the life cycle I wish I knew what my insulin was when I was a teenager I wish I wish I knew what my fasting insulin was I really wish I knew my postprandial insulin like in my teenage years in my

01:24:56 20s in my 30s well I knew it in my 30s starting at 35 are you a fan of continuous glucose monitors the hugest most gigantic fan of cgms I've never seen any tool that I've ever used in medicine change Behavior the way that cgms do wow why do you think they are so effective at changing Behavior I've tried one and I really liked it I learned that in the sauna my insulin or my blood glucose goes up probably by a bit of dehydration I learn what kind of foods work for me which don't um I I thought it was fascinating I

01:25:27 learned how every Behavior you could possibly imagine use your imagination impacts blood glucose totally fascinating to me including how a two wake wake-ups during the middle of the night versus one versus none impacted blood glucose the next morning fascinating for a data junkie like me it was like I was in heaven um why do you think they are so effective in changing behavior is it because of that that people can see that real time control like scan in and like oh that's the sandwich I think it's many

01:25:55 things I think it's generally the Enchantment of learning about your own chemistry and I love that and I think for me what I've seen you know I feel like doctors are basically marketers like the sacred marketing like our job as a physician is to convince people to do something that we think is good for them based on the best science but we can't just say here why don't you fill this prescription for a CGM you have to Market it you have to say I think this completely changes the way that you approach your pre-diabetes

01:26:31 I think this could dramatically affect your risk of Alzheimer's disease that you're so worried about that your mother has so our job as Physicians is to be that sacred marketer so cgms are one of my tools that I think are so crucial so enchantment number two yeah it's the real- time effect so if you go get your glucose and Insulin measured or maybe you do like a 2hour glucose challenge test where you look at glucose and Insulin at the fasting Point 1 hour later 2 hours later or more frequently that does not have the same kind of

01:27:05 behavior effect as having continuous data where you can say okay I drove to see you Andrew from my place in Berkeley and it was stressful it was torrentially raining and I know my glucose was elevated like I think really understanding what the the mediators are of your glucose control is essential now that said it's also kind of a later effect I mean I'd rather know your insulin and we know from uh the white head White Hall study that insulin especially postprandial insulin fasting insulin too can change years and years

01:27:44 before you get a change in glucose so um that's more for pre-diabetes and diabetes so I think those are the main reasons why I think it's such an important tool third thing is it democratizes data which you do too I mean incredible how you do that with your podcast but I think one of the most hopeful and exciting things that I'm seeing right now in the health space is that we're going from this patriarchal relationship where doctors hold the power and are The Gatekeepers of data to patients and

01:28:23 clients having having much more access to that enchantment about their own chemistry and their own biology so to me that is so exciting like for me to be able to I've got you

know probably 100 patients that are in a data stream with me where we're looking at their glucose and I can I mean I'm on spaical so I'm not doing this so much anymore but I can call a patient be like why is your glucose so high like what did you do oh it was my birthday I had a piece of birthday cake like that kind of collaboration that also is teaching the

01:29:01 patient to be their own clinician to me that is a loop of benevolence and integrity that I think is essential to creating Health we've got a disease care system we need the democratization of data to become a health-based system Amen to that a million times over we share that uh sentiment can tell it at a deep level I I think the pandemic actually assisted in well it harmed many things but it assisted in people's understanding that um no magic fery nor the government nor any anyone was going to arrive at their door with a kit of

01:29:39 things to make them healthy that provide sunlight movement sleep and all the various aspects of nutrition no nothing nothing that it everyone has to have access to first and foremost and then Implement those things as best they can speaking of which and kind of circling back to this idea of people in their late teens 20s 30s and onward if you had a magic wand and you could give like two or three don'ts or to make it personal if you could go back in time and erase certain behaviors what would the the don'ts

01:30:13 category be um you can tell us more than two or three um but if the goal is to maximize vitality and Longevity and those are not always uh parallel to one another certainly not the same thing sometimes orthogonal but let's just say fertility being a proxy for vitality and Longevity I think people will sometimes forget this that fertility isn't just about people who want to conceive children it's also it's a it can serve as a proxy for vitality and Longevity so uh what would you like to see patients

01:30:45 let's focus first on female patients but um if it extends to male patients as well what would you like to see them not do yeah or do far less of I really like that so I would say a few things I'll just headline them and then we can go into detail number one sleep I do want to diverge from you a little bit on some things but sleep is probably not one of them oh well feel free I mean you're the one that worked 100 you're the one that worked 120 hours a week sleeping much then's I can't imagine unless unless you

01:31:14 lived in a different reality than I do um uh you and there are times in my career where I was pulling all nighters and sleep deprived there just it I don't recommend it but I did it hope you don't do that anymore no longer if I can avoid it but there were years many years where it was like all right here we go and I I'm quite um Adept at it for one cycle yeah but two nights I kind of start to fall fall apart totally yeah so I would say sleep alcohol High perceived stress and I'd love to talk about maybe um the

01:31:45 data on telr and what we know so you'd like to see people get enough sleep so don't don't just yeah not all of these are concordant so um not enough sleep too much alcohol too much perceived stress eating the wrong Foods toxic relationships and isolation and then number six um not moving enough or not moving and exercising in a way that really fits with your body we start with that one actually cuz it's such a and then work backward um uh that's interesting I I think nowadays people appreciate the need for quote

01:32:30 unquote cardio I know that the the exercise physiologists cringe and and dissolve into a puddle of Tears when I say that but getting the heart rate up over some period of time longer than 10 minutes in order to generate cardiovascular health circulation so and resistance training of some kind maybe flexibility what what do you mean by Body phenotype or and exercise I'll speak from personal experience so what I did through I mean I gave up my 20s to medicine and during that time I occasionally got to the gym you know at

01:33:03 UCSF on pralis you could go to the gym and then as soon as your beer went off you're back into the hospital but I didn't exercise much I had um do you remember Nordic tracks I had a Nordic Track in my house and that was that was like it what I believe because for me the primary outcome that I'm interested in is cardiometabolic health so when it comes to exercise what I really feel if we're going to be at a population level I feel that about a third cardio 2/3 resistance training is based on my synthesis of the literature the best

01:33:42 combination and I think there's you know as you described with your s um study I think there's a minimal effective dose which for a population is about 150 minutes I think most of us need a lot more than that per per week per week but I think you know for me because I have a phenotype that produces a lot of insulin kind of depending on how I'm on my game I have a lot of glucose so I have to exercise a lot more to dispose that glucose so I think you then have to move from medicine for the population or

01:34:22 prescriptions for the population to what works for the individual I think that recommendation is fantastic um I think resistance training well let me put it this way I'm neither a trainer nor a physician but I've seen in family members that were doing I wouldn't say a lot of cardio but just cardio that when they add resistance training everything in terms including their biomarkers um have improved dramatically yes is in particular for female members of my family well one of the one of the mediators that I think is important

01:34:55 especially for people who do what I call chronic cardio which is what I did is cortisol so we know that um Runners especially marathon runners people who do a lot of cardio and don't

do much resistance training they tend to have much High cortisol levels and you can buffer that with vitamin C vitamin C can decrease the effect but chronic cardio doesn't always serve people so quick personal example when I first started measuring hor panels in myself I went to my physician and I said I'm 35 I've had one kid I want to have another

01:35:32 kid I've never been so exhausted in my life I just feel like I'm pushing a rock up the hill I've got this belly fat that I don't like and um I don't want to have sex with my husband so what do you think what could we do about this and he offered a birth control pill and an anti-depressant oh goodness so I left him and I went to the lab and I ran a hormone panel and my cortisol was three times what it should have been my insulin was in the 20s I was fasting my glucose was 105 my thyroid was mildly abnormal my

01:36:10 progesterone was low and that set me on this course of realizing that what I was doing as physician taking care especially of women was not getting to some of these root causes that are so essential and I would say I had to start first with cortisol at that time I was running four miles three times a week four times a week that was just Rising my cortisol further so that was not the right exercise for me I needed more adaptive exercise I started doing Pilates more yoga that helped to lower my cortisol I

01:36:43 mean it started me on you know changing the way I was managing perceived stress and it also changed my supplement regimen could we talk about that um what the moment you said lowering cortisol thought of the two supplements that come to mind are ashwagandha which I think can potently reduce cortisol but I've heard some recommendations about cycling it um and I've always wondered about time of day for ashwaganda intake because sort of quote unquote want cortisol elevated in the early part of the day yes and we know this uh we know

01:37:14 you do not want cortisol peaking later in the day no you do not interferes with sleep interferes with sleep um and then the other supplement is riola rosacea do I am I pronouncing that correctly yeah so riola is very effective it's been shown in multiple randomized trials to lower cortisol so that could be very effective what sort of dose I've started taking it recently by the way and I made a huge mistake I like to make the mistakes first so then my audiences don't make them um as I was taking it I

01:37:42 heard it was an adaptogen so I thought oh I'll take it before resistance training but of course you want the cortisol Peak during resistance training because that's going to set in motion the Adaptive response so I started taking it later in the day and it's really improved I would say my late day second half of the day cognition this is subjective to be fair I just feel like I'm in a more even plane of attention in the second half of the day so you're describing an NF1 experiment which is anec data it well it is not anecdotal so

01:38:10 I was taught at Harvard Medical School that the hierarchy of evidence starts at the lowest with expert opinion you know case studies then you've got cohort studies then you've got um observational data that's prospective then you have randomized trial but the highest quality evidence of all is the n of one experiment where you serve as your own control so what you're describing with riola I would frame that as n of one experiment where you have a wash out period and you compare before and after

01:38:41 and I'd like to measure some other metrics to see if there's an effect including your cortisol so rodial has been shown in multiple randomized trials to reduce cortisol the other thing that I think is super effective is phosph tile searing PS for short fish oil also more modestly reduces cortisol ashwaganda is interesting so in my first book the hormone cure which I read by the way you did I did I was hoping that was the one you read I did I read it and it's spectacular and I thought going into it

01:39:14 I had this like you know let's just call it what it was it's kind of male bias like is there going to be anything in here for me because uh I'm I don't have ovaries and you know is this going to be and it was IM mely informative um so thank you yeah I have very fond Recollections of the the walks I took listening to it and then I own the print version too so I like to switch back and forth so thank you for that it's a it's a superb book for anyone to read thank you I so appreciate that so in chapter 4

01:39:41 you may or may not remember that ashwagandha at least the time that I wrote that book ashwag ganda's data is not great but lack of proof is not proof against so with ashwagandha most of the comes from thousands of years of using it in itic medicine and it's considered again not my science hat it's considered a double adaptogen so that it's potentially helpful when you are um a high cortisol phenotype like I was like I sometimes still am or low cortisol I haven't found that in my patients although I'll give you one

01:40:18 exception so ashwaganda is mostly based on animal studies there's not as much human data but it is used a ton in Integrative Medicine the um there's one supplement that I found to be incredibly helpful for people who tend to have high cortisol at night and that's called a cortisol manager it's by integrative Therapeutics I don't have a second um supplement manufacturer that makes something similar it's their number one selling supplement because it's so effective is it a cocktail of several things it's a combination of phosph tile

01:40:51 Serene and ashwaganda tell tell me more about tile Serene I I am familiar with it for it's been mentioned by some guests that were on the Tim Ferris podcast long ago for other reasons I

think related to sleep yes um and maybe that's another reason why you like it um but before we move on from Rola is there a dosage of rodal or rosacea that you um so I would refer people to my book because the randomized trials and the doses that were used are in there so I can't remember with riola although I took it this morning to prepare to be

01:41:22 with you yeah we can look it up remember with phos sering I take that regularly so 400 to 800 m is the typical dose for PS and what's interesting is that in the randomized trials that were done 400 milligrams was more effective than 800 milligrams interesting I've found that for several supplements that the lower dose was more effective yes um yeah I won't it doesn't matter what those were and so when you say PS you were referring to by the way folks not PCOS just cuz scien and clinicians are familiar with and Military very familiar

01:41:56 with acronyms phospha tidal serin PS so 400 800 milligram 400 being more effective taken later in the day or early day does it matter it depends on when your cortisol is high so for me I tend to you know what's the pattern for cortisol typically it rises to its peak 30 to 60 minutes after you get up then it has this gradual kind of asmic decline until you go to bed so if you're someone like me who Peaks like way crazy high I don't do that anymore but that's what I used to do I need a phosph Serene

01:42:30 in the morning for people who are high at night who have what's known as a a flat cortisol pattern or a inverted pattern you want to take it at night and the flat pattern just quick sidebar is that that's associated with a number of conditions that most mainstream Physicians don't know about so a flat pattern where it's in the morning and it's high at night is associated with anxiety depression uh decreased survival from breast cancer that was studied at Stanford by David Spiegel that he was my

01:43:05 um coll close even collaborator even uh on the breath work study that we oh interesting yeah he's our associate chair of Psychiatry now a wonderful human being has has been a guest on this podcast and and I'm now fantasizing about a conversation that includes uh a panel of of uh Incredible Minds like you and David from the clinical side so in any case um yeah the late shifted cortisol not good not good not good and it seems to have the worst immune Downstream issues of any of the cortisol patterns so that's really important to

01:43:43 know about because it then maps to things like um it's related to PTSD so that's the pattern we see like in vets who've got PTSD as well as others it maps to autoimmunity it maps to fibromyalgia I was told that one in 12 people um have our heterozygous so one mutant copy or hypermorphic for some some mutation in adrenal related Gene so congenital adrenal hyperplasia is that true and if so that means that one in 12 people walking around are cranking out far too much cortisol or not enough cortisol all or the quol system is

01:44:25 already skewed in a direction that makes life more challenging at the levels we're talking about um did I hear that correctly because that one in 12 is not a small number it's not a small number it fits with what I see clinically I mean I want to see that data just to see um what does that mean and could you modulate it with environmental influences but it certainly fits with what I see you know I was taught once again in mainstream medicine that in terms of adrenal function it's very binary how most clinicians

01:44:59 think about it you either have Addison's disease and you don't make enough cortisol or you've got Cushings or cushingoid pattern and you make too much cortisol and anything in the middle is normal and my experience is that hell no like there are those of us like me who make a lot of cortisol I don't have Cushings maybe I've got one of these I wouldn't call it a mutant Gene I would call it more of a um vulnerable Gene so maybe I have one of those maybe that's part of the reason why I make you know two to three times

01:45:30 what I should be I'm aware of certain groups of individuals from within the military sector that um have there's a more frequent occurrence of some mutation in C C congenital adrenal hypertension not necessarily two copies which will if people look that up they're going to go oh wow there's all these phenotypes and um but sort of hypomorphic type thing so you know less than or too much cortisol and they are very good at staying up multiple days per night right uh multiple nights in series so they can pull all nighters

01:46:05 very easily they can push harder when most people would quit and everyone thinks well that's a great phenotype to have but guess what it's because they hyper produce cortisol yep and um so that's interesting and I think if we were to panel medical students and graduate students and you were to look at you know who's pulling excessive long hours who's stressed out a lot even outside of Academia and medicine and pushing pushing pushing really hard I think the ability to push and not crash we think of it as adaptive but in some

01:46:35 sense it's maladaptive over a series of years which is sort what were you described earlier yeah it's such a good point because you know you in some ways you'd want to select for that in certain professions like in the military like in medicine um but I would wonder for those folks about the downstream consequences of producing so much cortisol no it's got to be detrimental for their health in the long run and and you see that but even the data shows that if you're someone like me who makes a lot of

01:47:06 cortisol higher rates of depression like 50% of people with major depression have high cortisol levels higher rates of suicide um much more metabolic dysfunction we know that

trauma as an example maps to an increased risk of glucose metabolism issues and certainly High cortisol does that because it's one of the jobs of cortisol is to manage glucose and it's it kind of sets you up for um this one number five which is toxic relationships you know someone who hyper produces cortisol it's hard to live with

01:47:43 someone like that it's also I would say people that have this um let's just call it biological resilience um it's not always adaptive because you can stay in in bad circumstances longer the ability to to crash provided it's not suicide or life life destroying or you know long Arc of of pause and the requirement to you know take two years off from work or school or something um the ability to keep pressing on is is a double-edged sword let's put it that way um I want to make sure in staying within this

01:48:15 conversation uh because you mentioned fos serin we talked about Rola Rosa as we talked a bit about ashwagandha you've also talked about Omega-3s and fish oil in particular I'd love to know your favorite sources of these I think nowadays there's more General acceptance that getting these essential fatty acids is important do you have a threshold level of sort of grams I I've encouraged uh um podcast listeners to consider depending on what they're eating to try and get a gram of EPA or more per day

01:48:46 does that seem excessive um and what are the real data on epas because then the uh cardiovascular experts always hit back and say oh no you know it's not good for cardiovascular health and then you go well it's better than anti-depressants and other studies and they go no so I feel like if you really want to make your life difficult if you want to raise your cortisol you go on Twitter and you say something positive about Omega-3s of fish oil and um and you learn a lot um what are your thoughts on Omega-3s I take a

01:49:14 lot of them I've always been a big fan yeah so this is where I personalize I think some people need more than others and what I do is I measure your level so this gets back to nutritional testing so for you I would suggest an Omega Quant or one of my favorite cardom metabolic panels is to do a Cleveland heart lab so I think they they give me the most reliable information not just for lipids and subclasses and you know NMR fractionation but it also gives me an insulin resistance score it gives me um

01:49:48 levels of Omega-3s great we'll provide links to these different sites so people but one quick thing about that the whole story is not Omega-3s in taking fish oil so the work of Charley Siran at the Brigham is showing that the way that we resolve inflammation our understanding of it is really I think in the learning to crawl stage and so if you look at the omega-3 6 pathway in the body fish oils can help you know kind of push the reactions in a particular direction but typically they're not enough for the resolution of

01:50:30 inflammation now what most people do including my NBA players is they pop an ibuprofen or something like that when they've got inflammation that's got lots of other side effects that are not so good for you and we know in terms of the resolution of inflammation that taking something like ibuprofen reduces the amplitude of inflammation by about 50% but then it potentially blocks the complete resolution of inflammation so there's these new supplements that you may have heard of called specialized Pro

01:51:03 resolving mediators there's a lot of different supplement companies that make them and that combined with fish oil seems to be the best combination and what I do for athletes who've got you know kind of the normal aches and pains of the training load they have is all combine a little aspirin small dose just like um 81 Mig or two of those baby aspirin together with fish oil plus specialized Pro resolving mediators and there's some that are NSF they're certified for sports but the the dose I would say with

01:51:37 my patients some of them only need 1,000 milligrams your Gram that you mentioned for the population some of them need six gram together with spms so I think it has to be personalized how young um is it okay for people to start taking Omega-3s um for instance young women in their teens people in their 20s and their 30s young guys in their 20s and 30s should they take fish oil if just as a assuming they're not going to get anything tested I'm thinking about the college student who is really into biomarkers and that sort of thing we'll

01:52:14 go do some of this um but many people won't but they want to do the right thing so they'll try and drink a little less hopefully they won't smoke or vape please please don't smoke or vape the idea that vaping is okay it's like we had a whole episode so bad so bad for everything we're talking about let's end that chap exactly so just you know avoid they hopefully they'll try and avoid those things hopefully they'll avoid hard drugs um hopefully they'll avoid getting any STI if they do they'll resolve them

01:52:41 quickly hopefully yes um so but they might say oh well okay I'm willing to you know take some magnesium or take some phosph sering buffer my cortisol eat some vegetables um should they considering fish oil as a kind of a cross theboard in ulatory thing so I'd like to rank order these I would say fish oil yes I think a th milligrams as a general recommendation is good but I also have a food first philosophy so my preference would be that they're having salmon or some kind of Smash fish and they're getting that as the primary

01:53:12 source of their Omega-3s and then the days that they don't have fish I recommend it probably twice a week that they take fish oil then I would put magnesium next since so many people

are deficient then I'd probably put vitamin D what how many IU a vitamin D per day well you keep asking me this like for the the population yeah well for the let me put it this way for the LA for the lazy person or and this is an or not an and um or the person who um just doesn't have the finances to go get measured

01:53:43 levels measured because you know our audience is a huge range we've got people who can have tons of disposable income that list in the spot we have people with no disposable income so a th000 to 2,000 International you but my you know what I do is I dose to a serum level that's between about 50 and 90 great and so I have a vitamin D receptor uh snip and so I need to take about 5,000 a day to get to what I need a lot of people don't need that and you know there's some supplements that I don't know if they need so you

01:54:15 mentioned phosph tile sering for someone who's a college student and their cortisol is completely normal they're wasting their money on PS they don't need it they might need it later but they don't need it now I'd like to make sure that we Circle back to birth control in particular oral contraceptive birth control and we should touch on iuds perhaps a little bit more but what are your thoughts on S pure estrogen birth control this is what I learned when I was in college is that birth control is

01:54:45 basically tonic estrogen so constantly taking estrogen estrogen women are taking estrogen so that they don't get the estrogen priming of progesterone you're not getting any ovulation and I've known women that have been taking oral Contra or that took oral contraception as like estrogen pills basically for 5 10 15 years are there long-term consequences of this as it relates to pregnancy PCOS menopause what if so what are some of those consequences um what are your concerns what do you like about oral

01:55:22 contraceptive what do you dislike about them I like how balanced you asked that question so women who take oral contraceptives as long as you're describing like 10 years or longer we call those Olympic oral contraceptive users in terms of benefit I think that especially when they first came out and even now it gives women reproductive choice and That's essential as you may know our reproductive Choice has been declining recently so I'm a big fan in that regard and we've got a lot of data to show both

01:55:56 the risks and also the benefits of it so I'll speak first into the benefits because uh I'm going to get on a soap box a little bit about the risks so we know that it reduces the risk of ovarian cancer so there's something about this idea of incessant ovulation that is not good for the female body so if you look at for instance women who are nuns who uh don't take oral contraceptives and they have a period every single month of their reproductive lives they have a greater risk of a brain cancer so if you look then at

01:56:35 women who have uh several babies and they've got a period of time when they're pregnant that they're not ovulating and then they breastfeed for some period of time they have a lower risk of aaring cancer so oral Contra contraceptives help with reducing ovulation and reducing risk we know that if you take the oral contraceptive for about 5 years it reduces your risk of ovarian cancer by 50% and that's significant because we're so poor at diagnosing ovarian cancer early there's really no method that's really effective we use

01:57:11 ca125 and ultrasound screening especially in women who are at greater genetic risk but even that often we diagnose it you know in a later stage maybe just because that statement is going to highlight for a number of people um the question of what are some of the Sy earliest symptoms that people can recognize without a blood test so is ovarian cancer is it going to be pain so the problem is the symptoms are so vague and they're so non-specific one of the most common symptoms is bloating and we've already

01:57:41 talked about constipation we've talked about how women have this longer track GI track and so bloating is a really common experience for most women you can have bulk symptoms you know feeling like your your lower belly is kind of pressed out so the way that we inform women in terms of watching for this is to get regular gynecologic exams um for women who are at high risk where they have for instance an ultrasound for some reason it shows a mass that we're concerned about there's a way to triage

01:58:14 that in terms of what kind of evaluation that they need and that's a situation where you might get a blood test called a ca129 ca1 25 the um yeah the problem is the symptoms are so vague it could be it depends on how big the tumor is how much bulk you have what it's pressing on so if if um taking estrogen and thereby reducing the frequency of ovulation lowers the risk of ovarian cancer should women that are even women who are not sexually active so they're they're not actively trying to get pregnant or avoid

01:58:50 getting pregnant but if they're not sexually active then the probability of conceiving unless they go through some IUI or some other route is is very low as far as I know um that's what I was taught in high school anyway um would they be wise to suppress ovulation for periodically using hormone-based contraception just so that they can offset the risk of ovarian cancer that's a very rational question and I would say that's what mainstream medicine has had at its back to recommend oral contra cves not just for women who are seeking

01:59:24 contraception but for acne for painful periods for really kind of the drop of a hat they're prescribing oral contraceptives that's what I was taught to do but there's so many

consequences and I think the issue here is more about consent because in OBGYN and I started out as a board certified OBGYN and I now mostly see men but I was taught as an OBGYN to convince women to go on the oral contraceptive and I think a lot of that is pharmaceutical influence so maybe we could talk about the risks and why the answer is no to

02:00:03 your question um as we do that could I just ask is the um the so-called ring the new it used to be called the NOA ring maybe that's a brand name but it when I was in college there was all this discussion about the ring all right by both men and women for reasons that don't belong on the podcast um use your imagination folks so um is the the ring obviously it's not oral it's not oral hormone contraception but it's hormone-based right the ring is releasing estrogen locally as opposed to taking it orally but would you would you

02:00:31 slot it under what you're about to tell us in terms of the concerns so we have less data about the ring so the oral contraceptive is two hormones it's ethany estrad and it's a progestin so it's not the normal uh progesterone that your body makes your ovaries make and your adrenals make it is a synthetic form of progesterone and it is the same progestin similar same class that was shown to be dangerous and provocative in the women's health initiative so I'm not a fan of progestins I do not recommend them for

02:01:13 any woman unless the consequence of not taking them is surgery or some other um you know unless it it gives them some freedom in some way so I don't like progestins the uh Nar ring is estrogen plus progestin but it's released transdermally through the vagina so given the the way that um it's delivered to the vagina the doses are lower than what's taken orally but in terms of some of the risks that I'm about to talk about we don't know about much of the data yeah we think that it's similar there's probably a spectrum of risk and

02:01:56 the ne ring is a little more towards the middle than you know what I'm talking about with oral contraceptives okay are you ready for that yeah I'm ready for the risks okay so like with almost any pharmaceutical the oral contraceptive depletes certain micronutrients so magnesium there's certain vitamin BS that are depleted uh it also affects the microbiome that data is not as strong but there seems to be some effect and there's also an increased risk of inflammatory bowel disease in autoimmune condition it increases inflammatory tone

02:02:35 so the studies that I've seen increase one of the markers of inflammatory tone High sensitivity CRP by about 2 to 3x it seems to make the hypothalamic pituitary adrenal axis more rigid so that you can't kind of roll with the punches and wax and Wayne in terms of cortisol production the way that you can off the birth control pill it can affect thyroid function I'm thinking of the slide that I have that has like 10 problems associated with oral contraceptive but that's what I can remember right now

02:03:12 that's very helpful and it makes me wonder whether or not if on the one hand oral contraceptives are protective in women against ovarian cancer but then they have these other issues yeah there's one another I want to mention please anytime you take oral estrogen it raises sex hormone B globulin and you've talked to other podcast guests about this Kyle I think sex hormone binding globulin I think of as a sponge that soaks up free estrogen and free testosterone so when you go on the birth control pill you raise your sex hormone

02:03:44 binding globuline it soaks up especially free testosterone and for some women it's not a big deal they don't notice much of a difference but then there's a phenotype maybe related to CAG repeats on the Androgen receptor who are exquisitely sensitive to that decline in free testosterone so this then opens the portal of talking a little bit about testosterone and women so we've mentioned already that it's the most abundant biologically the most abundant hormone in the female system even though men make almost 10 times as

02:04:19 much or even more than 10 times it is so important for women it is essential to so many things not just sex drive and muscle mass and seeing a response to resistance training but also confidence and agency and so those women who are so sensitive to their testosterone level they've got this high sex hormone Bing globulin their testosterone declines what they describe is vaginal dryness maybe a decline in sex drive but there's also this bigger issue related to confidence need agency even risk-taking from studies that we've done

02:04:55 with MBA students that I think is a serious problem maybe the most important out of all of these things is that it can shrink the clitoris by up to 20% 20% and that includes the a regression of the of the nerves that innervate the the clitoris is that I mean that's a very good question as a neuroscientist yeah I would think uh used to teach uh the neural side of of reproductive Health we need to do a series on Sexual Health maybe you would co-host that with me sure I we could certainly use your expertise

02:05:25 I think um yeah that's a dramatic that's a dramatic number yeah but then let's go back to the sacred marketing if I've got a woman that I think should not be on the birth control pill maybe she's taking it for acne or she's taking it because her periods were a little painful what I'm going to do is say let's leverage these other ways of making your period less painful let's take the message of your painful periods and figure out okay is it your inflammatory tone and we give you some fish oil and spms maybe a little aspirin

02:05:55 when you've gotch your period like let's find some other ways to deal with it than to take the oral contraceptive which you have not received informed consent about because it can

trick your by up to 20% now that usually convinces most people to the elevation in sex hormone binding globulin does not seem to go away when you come off the birth control pill to me that is the biggest problem problem with prescribing oral contraceptives now the data that we have is limited there's one woman who uh Claudia something

02:06:30 something who looked at sex hormone binding globulin a year out from stopping the birth control pill and it was still elevated it wasn't as high as it was when they were on the pill but it was still elevated so your question about reversibility I don't know if we know the answer to that wow okay um that's yeah that's a significant statement and something that for consideration related to this although this might seem not related it is how early do you recommend that women go get their follicle number assessed in

02:07:08 other words to get a size a sense of the size of the ovarian reserve and their amh levels U measured um I'm going to I'm an amateur Outsider as I say this but we have an episode on infertility where I just describe the ovulatory menstrual cycle yeah um and I'm not the best person to answer that yeah well we can I'm too far off from it okay well um I suppose then from taking the perspective of somebody who thinks about fertility in terms of at least congruent with vitality and Longevity would given

02:07:39 that it's fairly non-invasive it's an ultrasound or a blood draw or amh or both is there any reason why a woman would not want to get her follicle number assessed or her amh levels assessed is there any reason why because I was shocked to learn that most women don't do this until they're hitting their late 30s or early 40s and they haven't conceived or they suddenly decide that they want to conceive and I thought why doesn't every doctor insist that their female patients get have their amh level addressed so that if they need to

02:08:11 freeze eggs it's cost yeah so I think if you've got the disposable income to do it go for it it's not included in a standard blood panel no wow the only way women in my practice who've had amhs done and have looked at their follicle count are women who want to freeze their eggs or and that requires disposable income or they um are having trouble getting pregnant so they are in the reproductive Endocrinology system and they're getting an evaluation and then they're also um the women who have symptoms of

02:08:48 early menopause so premature ovarian insufficiency which is before age 40 uh those are the women that I see getting attested and I think you're right that it should be offered more broadly it speaks to the democratization of data again and I think most women don't know that so you're doing a huge service I think to be speaking into this one other point related to that is that what I see in conventional medicine is that when a woman asks for a hormone panel and she's not trying to get pregnant she usually gets told that

02:09:29 hormones vary too much it's a waste of money you don't need it or if you're feeling hormonal why don't you go on a birth control Bill unless she's trying to get pregnant if she's trying to get pregnant suddenly those same tests are very reliable and they get you know their their testosterone their free testosterone their thyroid pain they get their estrogen and progesterone maybe they get their cortisol they get their amh so there's a double standard between those who want to get pregnant and those who

02:10:02 don't and that needs to end yeah I totally agree as I've learned more about um ovulatory cycle and amh and and the anal population of follicles all it's fascinating it just seems to me wow a relatively straightforward test one definitely invasive ultrasound but I don't consider that yeah not terribly invasive but invasive uh at least but the other one just pure blood test just seems like why wouldn't why wouldn't this be offered a covered by insurance or or you know that anyone that wanted it but now now I understand

02:10:33 why you mentioned menopause huge topic enormous topic uh we had a guest on the podcast who's not a clinician who said something in passing so I wanted I likely to get this wrong um but what they said was that the results of the large scale trials on hormone replacement therapy for women for menopause said something to the effect of if the hormone therapy was started early enough it was very beneficial for yes vitality and health outcomes whereas if women went through menopause and then initiated the hormone

02:11:09 therapy hormone replacement therapy that it could be detrimental to their health so first of all uh do I recall that statement correctly and then second of all what sorts of hormones are being replaced is it just estrogen and how is that done is it done through birth control so oral contraceptives never Rings what are your thoughts on menopause when should people start thinking about it and what is the palette of things available so that we can do an entire episode with you on on this topic in the future but just to I you know I

02:11:41 get a lot of questions about this and and I'm guessing based on everything you've told me today that there are women in their 30s that while they may be 20 years out from menopause probably should be doing things now in anticipation of that yes so we haven't talked about the 30-some but I totally agree with you the more you know about your phenotype your hormonal phenotype when you're in your 30s you're set up in terms of what to do in the future especially things like your thyroid your estrogen and progesterone levels because

02:12:11 you can replace to a state of your thyroid whatever that is for you you can replace I don't usually go exactly back to where the estrogen and progesterone levels were were but we can

get pretty close so in your 30s having a base case I think is really essential so you spoke to the Women's Health Initiative which was published in 2002 and we went from a huge number of women taking hormone therapy to a very small percentage like in the range of 5% and that means we've got millions millions of women who are

02:12:47 suffering needlessly with things like insomnia difficult with their mood difficulty with sex drive um feeling like they are closing the store in terms of sex because they're not on hormone therapy I would agree with the statement that you made that hormone therapy particular forms that are similar to what your body always made when it's given judiciously at the right time typically within 5 to 10 years of menopause which is 51 to 52 that it is incredibly safe so it's a complicated study the women's

02:13:24 health initiative but it was the the wrong study in the wrong patients with the wrong medications and um with some of the wrong outcomes so it was powered to look at cardiovascular outcomes it was not powered to look at breast cancer it was stopped because of breast cancer risk but what happened in the control arm of the study was that they had an incredibly low rate of breast cancer and so as a result they ended up having this increased risk of breast cancer at 5 years and they stopped the study now the study was done with

02:14:01 synthetics it was done with conjugated equin estrogen known as Premarin and mroy progesterone acetate those were the so-called estrogen and progesterone those are uh synthetic hormones we think especially the progest is associated with the greater risk of breast cancer although the the subsequent re-evaluations of the data now 18 years out have shown that um this problem with the control group and no increased risk of breast cancer um and for the women who got estrogen only those who had a hysterectomy the Premarin they actually

02:14:40 had a decreased breast cancer risk and decreased breast cancer mortality so there's a lot to be said about this I'm trying to keep it really brief brief but if you look at the women 50 to 60 So within 10 years of menopause they're the ones who seem to have the greatest benefit so they had a decreased subclinical atherosclerosis so less cardiovascular disease they had an improvement in terms of um bone health um less progression to diabetes and then over the age of 60 they started to have greater risk of certain outcomes

02:15:22 such as cardiovascular disease myocardial infection and so on you asked about um what do I do and to me this problem is not just menopause what's more interesting is to talk about per menopause so per menopause is the the period of time before your final menstrual cycle and for most women depending on how attuned you are of the symptoms it can last for 10 years so I'm still in Period menopause it's been like 20 years because I've been tracking it so carefully it usually gets kicked off by having your cycle get closer together so

02:16:06 that can happen in your 30s or your 40s you go from 28 days to 25 days that sort of thing you may notice that you start sleeping more poorly because progesterone is so important you talked about that with Kyle you may notice it as more anxiety difficulty sleeping and that probably is related to the estrogen receptor so e Alpha is estrogen receptor Alpha is enio um it increases anxiety ER beta is associated with an angiolytic activity and then there's a total of about six estrogen receptors now there's the the G

02:16:42 protein coupled estrogen receptors and those are mixed angiolytic angiogenic so um there's this whole period of paropa and what's Most Fascinating to me and we've got to talk about this either today or another time is that there is this massive massive change that happens in the female brain that people are not talking about enough and so looking at the work of Lisa mascone at Cornell from uh starting around age 40 there is this massive change in cerebral metabolism so you can do fdg pet scans you can look at glucose uptake and

02:17:21 there's about on average a 20% decline from Prem menopause you know up to like age 35 to per menopause to postmenopause the women who are having the most symptoms in per menopause menopause The Hot Flashes the night sweats the difficulties sleeping those are the ones who have the most significant cerebral hypo metabolism so it's almost like a um I don't I don't want to scare people with this language but it's it's a lowlevel or let's call it pseudo dementia of sorts yes it it seems to be a phenotype that you can then map to

02:18:02 Alzheimer's disease because that's Lisa musc's work she's looking at okay Alzheimer's disease is not a disease of old age it is disease of middle age what are some of the biomarkers that we can Define that can tell you what your risk is I've got a mother and a grandmother with Alzheimer's disease you can believe I am all over this data and insulin resistance ins sensitivity as we talked about it before um seems to be somewhere in there which I think when that first when that idea first surfaced a few

02:18:32 people are like really but then of course right I mean the brain is this incredibly metabolically demanding organ you deprive neurons of fuel sources they or you make them less sensitive to fuel sources they start dying they they certainly start firing less it makes perfect sense and I think now it's thanks to Lisa's work work that you've you've done in a talked about quite a lot is um in your books and elsewhere I think has really you know highlighted for people that metabolism and metabolomics is going to be as important

02:19:02 as genes and genomics when it comes to right dementia perhaps especially in women is it safe to say that I think I think so because we believe that the system is regulated by

estrogen so the decline in estrogen starting around age 40 43 is kind of the average seems to be the driver behind cerebral hypometabolism the way I describe it to my patients is it's like slow brain energy so you walk into a room you can't remember why like you just notice that you can't manage all the tasks the way that you once could

02:19:40 like things are just a little slower and I say that to women they're like I have that like help me so this is then circling back to WHI where women are scared to death of taking hormone therapy and we've got all of these women that are marching toward potentially a greater risk of Alzheimer's disease and they have this opportunity in their 40s and their 50s to take hormone therapy and they may not be offered it because the typical conventional approach based on WHI is to say unless you're having

02:20:14 hot flashes and night sweats that are severe I'm not going to give you hormone therapy and I just want to call that out I would say no that is not the way to approach it further the concept right now in conventional medicine is that hot flashes and night sweats are these nuisance symptoms that we will take care of temporarily maybe with a little bit of estrogen progesterone or birth control pill because it's given a lot or that they pass this idea you know suck it up suck it up doesn't matter that

02:20:45 you're not sleeping anymore you know turn down the temperature in your room and that's not right because hot flashes and night sweats are a biomarker of cardiometabolic disease they are a biomarker of increased bone loss they are a biomarker of changes in the brain so many of these symptoms that occur in perimenopause are not driven by the ovaries they are driven by the brain yeah it's the bidirectional cross talk between the body and the brain keeps you know I think is this resounding theme uh we had Chris Palmer

02:21:20 on here a psychiatrist who's talking about ketogenic diet for treat mental health I know you we could have a whole other discussion and we will I hope if you'll agree to it about nutrition and as it relates to hormones um specific diets and so forth but the and that's a question too whether this problem of cerebral hypometabolism could we solve it with estrogen Andor increase metabolic flexibility so I just wanted to footnote that sorry to interrupt you no please uh please interrupt um uh I know you're

02:21:54 as long as we're there I know you are a fan in some instances of intermittent fasting time restricted feeding Andor ketogenic diet yes um to get cells sensitive to insulin which is not to say if I understand correctly which is not to say that women need to stay on the ketogenic diet for long periods of time or intermittent fast by only time restricted feeding for 8 hours or 6 hours a day but that by increasing you said metabolic flexibility excuse me but by increasing cells sensitivity to insulin and then

02:22:28 maybe returning to a more typical eating pattern and periodically switching back and forth that might actually be beneficial do I have that right yeah I love the pulse so I feel like it's much more physiologic than say going on a ketogenic diet and staying there for years all of the data that we have on the ketogenic diet it's pretty limited in terms of duration you know the the longest players that we have in terms of the data are the folks with epilepsy and that's just a different phenotype so I

02:22:58 think in terms of microbiome effects diversity dysbiosis some of those issues we really don't know in terms of long-term effects so I prefer with a ketogenic diet that it's used as an off one experiment and that you do it for four weeks maybe you measure biomarkers before and afterwards maybe look at your stool before and afterwards and we still haven't talked about stool tests yet but you could measure you're fasting insulin and your glucose you could just start there do four weeks of Keto clean keto including vegetables

02:23:29 doesn't have to be 57 a day and then measure it again afterwards since you mentioned stool testing yes um what is your recommendation about stool testing so my recommendation this is again in the field of if you have the disposable income so I usually start with goova because they've got a good co-pay system with insurance that's what I typically use so I usually do their one day stool test where you have to go digging through your stool and send it off to this lab that's in North Carolina

02:24:05 I usually do the one day unless I'm concerned about parasites in that case I tend to do three days I do that for people who travel a fair amount and go to places where there's greater risk or they just have gut symptoms another test that I do a lot is um cuz I was like to mention two Labs is a test by longevity and this is much more of a data wonk uh type of test because it's powered by AI it was designed by um a guy who's got inflammatory bowel disease and he is a um he's a PhD deep phenotyping bioinformatics guy

02:24:45 who wanted to make this really easy so the test is under the umbrella of thorn and um they used call it gut bio they might have another name for it and they just improved it so that it's a wipe instead of digging through your stool and so my athletes will do it now they were not so into digging through their stool before is anybody really no one is I don't want the answer I know the answer I prefer to that question but that's a super interesting test because it's you get much more dense data the issue is um um

02:25:21 with apologies to my friends at Thorne the issue is that their recommendations end up being Thorne supplements so that can be very easy for people who want to you know connect the

dots that's not always the way that I like to do it uh first of all three things um you've shared with us an immense amount of knowledge uh and in that first statement I also want to apologize because I threw you the entire lifespan of uh female lifespan reproductive Health contraception diet uh microbiome so many things but um I

02:26:00 first I just want to say you've taught me a tremendous amount um including I think something that most people including myself have not thought about enough which is the psychosocial impact on things that we're all familiar with constipation bowel movements what we eat what we avoid I have to say really a huge thank you for that because it's not something that's been discussed on this podcast before sort of know that brain communicates with body psychology and biology are linked but I think this is

02:26:34 the first time that anyone's ever directly linked circumstances and biology and psychology in such a concrete way so that's the that's the first thing and I I speak for many people on that second of all we barely scratch the surface of your know knowledge and um which is both uh frustrating for me because uh it I always want to learn more and I know many other people do as well but also very very exciting because uh with uh hopefully without much persuasion we can have you back on to talk about pers at

02:27:05 all like men uh I know you're working with men now Men's Health um some particulars around per I think there's more for us to explore in terms of PCS menopause contraception and all of the above but then something that you and I were talking about off camera um before started which I think is a really important factor that ties back to this issue of of trauma and stress and the bidirectional relationship between biology and psychology hopefully someday we won't even separate those two um which is the use of specific medicines

02:27:37 including plant medicines yes and how that can influence overall health which no doubt will include Hormone Health so I say all of that for two reasons first of all to queue up the we won't even call it a part two but a equal to to this which um I'm gratified to hear that you you'll join us for that and then also to just really extend a huge thank you the amount of knowledge that you shared is is immense and uh is going to be very very useful and actionable for for men in terms of their thinking and

02:28:08 their actions and for women in particular today's discussion in particular for women in terms of how to think about their health and biology how to think about their psychology and the environment that all of that embedded in so I just want to say an enormous thank you thank you Andrew I so appreciate that and I so appreciate what you offer to the world in terms of a way in a way to understand physiology and how to craft a architect a better life um can I just add one last thing because I didn't talk about it since we

02:28:41 didn't get to the 40s and the 50s in this list of biomarkers to so I feel like if people if women went away with one thing today it would be to do a coronary artery calcium score by age 45 and sooner if you've got premature heart disease how is that taken so it's a CT scan of the chest you can self-order it like I think at Stanford Hospital you can self-order it last time a patient checked it was \$250 so again disposable income but it it tells you it it almost gives you this fork in the road in terms of how much

02:29:16 you need to pay attention to cardiometabolic health as a woman and it's 45 for men too so if you haven't had one have you had one no you need one insulin cortisol CAC great so I'll run all that by you it's really essential and it's um yeah it's it's so fascinating because you know there's some women who have a zero so my score is zero and that's great so often you can just keep doing what you're doing but if you're 45 and you're starting to be elevated or you've got you know maybe you've got PCOS or

02:29:52 you've got some other biomarkers tending you in this direction toward the number one killer really eight to nine out of the top 10 killers in the US that allows you to really start to make changes and I I think it's essential to know that data it's not it's probably not going to be offered by your doctor certainly Peter AA is going to offer it but most conventional doctors are not going to do it and then the last thing I want to say before you mention so if I were to go to my doctor and I just say I want a a cardiac

02:30:21 calcium score that's what people coronary artery calcium score CAC okay so everyone hear that and know that if you're 40 or older and maybe if you're 45 or older get get it so the last thing is and this for men and women is your a score so adverse childhood experiences knowing your a score is so essential in terms of a baseline for how much trauma your system your Pine system endured when you were a kid and we know that childhood trauma whether it's abuse or neglect or you know having an alcoholic parent that maps to disease in

02:31:02 middle age and it can give you so much insight I'll give you an example I've got a patient who had an elevated coronary artery calcium score who does everything right with her food I think it was her trauma that elevated her C when she was 45 so I think an a score knowing your a score starting as a teenager like knowing it and knowing how to work with that is really essential there are certain people they are exceedingly rare but you are one such person that when they speak knowledge just comes from comes out of

02:31:34 them and it's incredibly useful and helpful knowledge so thank you I'm going to get both of those things good um and I highly recommend everyone else pursue ways that they can get

those or if they can't get them that they you know earmark those as things to get at the point where they they can obtain sufficient uh disposable income sounds like that the health uh the detriments to health that those can offset would be well worth the cost totally thank you thank you for joining me for today's discussion all about

02:32:05 female hormone Health vitality and Longevity with Dr Sarah gotfried if you'd like to learn more about Dr gotf Freed's work please check out her social media channels we've provided links to those in the show note captions in addition please check out one or all of Dr G reads excellent books that she's written about nutrition supplementation and various treatments for Hormone Health longevity and vitality we've linked a two of those notably women food and hormones and her book the hormone cure in our show note captions if you're

02:32:34 learning from Andor enjoying this podcast please subscribe to our YouTube channel that's a terrific zero cost way to support us in addition please subscribe to the podcast on Spotify and apple and in addition on both Spotify and apple you can give us up to a five-star review if you have questions or comments or topics or guests that you'd like me to cover on the hubman Lab podcast please put those in the comment section on YouTube I do read all the comments in addition please check out the sponsors mentioned at the beginning

02:33:01 of and throughout today's episode that's the best way to support this podcast if you're not already following us on social media we are hubman lab on Instagram Twitter Facebook and LinkedIn and I should mention that on both Instagram and Twitter I cover science and science related tools for mental health physical health and performance some of which overlap with the contents of the ubberman Lab podcast but much of which is distinct from the contents of the hubman Lab podcast again at hubman lab on all social media channels and if

02:33:27 you haven't already subscribe to the hubman Lab podcast so-called neural network newsletter that's a monthly newsletter it's completely zero cost and we provide summaries of podcast episodes as well as summaries of tools for everything from optimizing sleep to Hormone Health deliberate cold exposure deliberate heat exposure Fitness and so on it's very easy to sign up for you go to hubman lab.com go to the menu and scroll to newsletter you simply provide your email we do not share your email with anybody as I mentioned before it is

02:33:53 completely zero cost again that's the neural network newsletter and you can find it at hubman lab.com during today's episode and on many previous episodes of The hubman Lab podcast we discuss supplements while supplements aren't necessary for everybody many people derive tremendous benefit from them for everything from sleep to focus to hormone regulation the ubberman Lab podcast is happy to announce that we partnered with momentus supplements because momentus supplements are of the absolute highest quality also they

02:34:19 include many single ingredient formulations which is essential if you wanted to design a supplement regimen that is both cost- effective and the most biologically effective supplement regimen that's very hard to do with blends of supplements it's very straightforward to do with single ingredient formulations also momenta supplements ship internationally which is important because we realize that many of you reside outside of the United States if you'd like to see the supplements discussed on the hubman Lab

02:34:42 podcast you can go to Liv momentus spelled ous so that's liv.com huberman thank you once again for joining me for today's discussion all about female hormone Health vitality and Longevity with Dr Sarah gotfried and last but certainly not least thank you for your interest in science [Music]

00:00:00 welcome to the huberman Lab podcast where we discuss science and science-based tools for everyday life I'm Andrew huberman and I'm a professor of neurobiology and Ophthalmology at Stanford school of medicine today my guest is Dr Sachin Panda Dr Sachin panda is a professor and director of the regulatory biology laboratory at the Salk Institute of biological studies his laboratory has made numerous important contributions that impact mental health physical health and human performance for instance his laboratory

00:00:33 discovered the neurons in the eye and neurons within the brain that regulate our so-called circadian rhythm circadian rhythms are 24-hour rhythms and everything from gene expression to the overall functioning of tissues our levels of mood and alertness our ability to sleep appetite and much much more in addition over the last decade Dr Panda's laboratory has made critical discoveries in terms of how our patterns of eating over time impact our biology and our health in particular his laboratory Pioneer discoveries related to so-called

00:01:04 intermittent fasting also sometimes referred to as time restricted feeding today Dr Panda and I discuss how our circadian behaviors everything from when we wake up to when we view light to when we avoid viewing light to when we eat and what we eat and when we socialize and how we socialize impacts our biology and our psychology energy and how all of that has a strong impact on our health during today's discussion you will learn how restricting your feeding to specific periods within each 24 hour cycle or

00:01:36 perhaps even exploring longer patterns of fasting and eating Cycles can impact everything from the health of your liver to your gut to your brain and how all of that impacts things like mood and your ability to perform cognitive work indeed today's discussion goes deep into all aspects of intermittent fasting AKA time restricted feeding we talk about the basic science as well as the recent clinical trials that have explored time-restricted feeding in a diverse range of people including men women

00:02:07 children people with diabetes people who are otherwise healthy and much much more I'm quite aware that intermittent fasting is a topic of much debate these days we go deep into that debate and by the end of today's discussion you can be certain that you will have learned all the latest and all the details all all made very clear to you thanks to the incredible expertise Discovery and clear communication of Dr Panda as some of you may already know Dr Panda has authored several important books on the topic of

00:02:36 intermittent fasting and how it can benefit various aspects of Health those books include the Circadian code and a more recent book the Circadian diabetes code both of which we've provided links to in the show note captions in addition if any of you are interested in learning more about Dr Panda's work including seeing his Publications and reading those Publications we're

supporting his laboratory you can do that by going to his laboratory website which we have also linked in the show note captions

00:03:02 before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford it is however part of my desire and effort to bring zero cost to Consumer information about science and science related tools to the general public in keeping with that theme I'd like to thank the sponsors of today's podcast our first sponsor is hvmn Ketone IQ hvmn Ketone IQ is a supplement that increases blood ketones I want to be clear that I am not following a ketogenic diet most

00:03:30 people fall into this category they are not following a ketogenic diet they are omnivores and they do eat carbohydrates so their standard fuel source for the brain and body is not ketones however I found that by taking Ketone IQ which we know increases blood ketones I can achieve much better focus for longer periods of time for any kind of cognitive work and much greater energy levels for exercise especially if I'm going into that exercise fasted and find myself a little bit hungry when I start

00:03:58 that exercise this is no surprise we know that ketones are the brains and body's preferred fuel source even if you're not following a ketogenic diet so in other words I and many other people are now starting to leverage endogenous ketones as a fuel source for the brain and body and yet we are not following a ketogenic diet and of course if you are following a ketogenic diet Ketone IQ will further allow you to increase your blood ketones as a source of brain and body fuel if you'd like to try Ketone IQ

00:04:26 you can go to hvmn.com huberman to save 20 off your order again that's hvmn.com huberman today's episode is also brought To Us by eight sleep eight sleep makes Smart mattress covers with cooling Heating and sleep tracking capacity as I've talked about before on the huberman Lab podcast there is a critical relationship between sleep and body temperature that is in order to fall asleep and stay deeply asleep your body temperature needs to drop by about one to three degrees and in order to wake up

00:04:54 in the morning and feel alert your body temperature needs to increase by about one to three degrees the problem with most people's sleeping environment is that even if you make the room cool the actual environment that you sleep on that is your mattress and underneath your covers is hard to regulate in terms of temperature with eight sleep regulating the temperature of that sleeping environment becomes incredibly easy in fact you can change the temperature of that environment across the night making it a little bit cool at

00:05:20 the beginning of the night even cooler still a few hours into your sleep which really helps getting into very deep sleep and then warming it as you approach warnings so that you wake up feeling most alert I've been sleeping on an eight-sleep mattress cover for over a year now and it is completely transformed my sleep if you'd like to try eight sleep you can go to eightsleep.com huberman to save up to 150 off their pod 3 cover eight sleep currently ships in the USA Canada UK select countries in the EU and Australia

00:05:49 again that's eightsleep.com huberman today's episode is also brought To Us by thesis thesis makes custom nootropics now I am not a fan of the word nootropics because it translates to Smart drugs and as a neuroscientist what I can tell you is that you have circuits in your brain that allow you to focus you have circuits in your brain that allow you to be creative you have circuits in your brain that allow you to task switch and on and on in other words there is no specific brain circuit or even circuits for being quote unquote

00:06:17 smart thesis understands this and has developed nootropics that are customized to different types of mental operations what do I mean by that well they have formulas that can put your brain into a state of increased Clarity or Focus or creativity or that can give you more overall energy for things like physical exercise I often take the thesis Clarity formula prior to law long bouts of cognitive work and I'll use their energy formula prior to doing any kind of really intense physical exercise if

00:06:48 you'd like to try your own personalized nootropic starter kit go online to takethesis.com huberman you'll take a brief three-minute quiz and thesis will send you four different formulas to try in your first month again that's takethesis.com huberman and if you use the code Huber minute checkout you'll get 10 off your order the huberman Lab podcast is now partnered with momentous supplements to find the supplements we discussed on the huberman Lab podcast you can go to live momentous spelled ous

00:07:13 live momentous.com huberman and I should just mention that the library of those supplements is constantly expanding again that's livemomentous.com huberman and now for my discussion with Dr Sachin Panda Sachin Dr Panda so good to see you again yeah good to see you we are colleagues still but we used to be right across the street from one another yeah yeah you remember those days yeah yeah so I'm delighted that you're here um I think we're going to talk about a number of things mainly intermittent fasting time restricted

00:07:43 feeding and health but also the many other things that you're doing just before we started recording we were discussing your recent paper in nature uh that involved recordings from post-mortem Human retina so maybe if there's time at the end we can get back to uh your lab has shown that you can essentially maintain or resurrect neurons from uh dead people in order to

potentially and eventually provide transplants to rescue Vision in the blind so that's extremely exciting but of course not the main focus of today's discussion so

00:08:16 we'll have to uh split it up um the first question I have is how am I supposed to Define fasting and time restricted feeding in meaning when I go to sleep every night I'm not eating so in some sense everybody is doing time restricted feeding to some degree or another yeah at what point can we start thinking about a pattern of eating as time restricted feeding so-called intermittent fasting does it have to do with how regular one is about the start and stop times how do you think about defining intermittent

00:08:48 fasting time restrictive feeding and maybe just to simplify the conversation is one term more correct than the other in terms of describing this incredible pattern of feeding well you know that intermittent fasting covers many types of fasting um so actually it started long time ago and it's embedded into the history of caloric restriction um almost 100 years ago people showed that if you reduce calorie intake in a rat then that rat can live for a long time and in those experiments the calories

00:09:24 were reduced every single day and that led to the idea that if we cut down our calories by 20 percent say then we can potentially live longer by doing two things one is preventing is related disease or even if we follow fall sick maybe we can accelerate cure and keep the repair mechanism going so that we can live longer but it was very difficult to count calories every day and reduce maintain that um I must say that it's not that calorie restriction is impossible or we are not doing it in fact a lot of us we do

00:10:09 um count calories in our subconscious mind means every time you took out it you took out we take out a soda bottle or something I'm looking at it okay or in 60 kilocal or 30 kilocal or zero kilocal we are doing that so the point is it's we are doing subconsciously some kind of calorie counting but reducing calorie by Twenty thirty percent every single day is not possible for many people so then the idea came in mouse and rat experiment whether they can eat every other day um and in fact this every other day

00:10:46 feeding um also led to very similar almost equivalent Health Improvement as continuous calorie restriction um so then the idea was well every other day is a little bit hard for humans but just imagine I would just get to eat only one day and then another day then the idea came well for humans can they eat less for one or two days in a week so that led to this pipe two diet where people can eat for five days and then two days they have to reduce calories so that's also intermittently people are fasting

00:11:25 um then as you know Walter longer also came with this idea that periodic fasting maybe four or five days in every month or two months three months you can fast or reduce calorie and he also found many benefits of calorie restriction was there were those studies on humans many of the studies started it in mice but alternate day fasting five two and um Walters periodic fasting all of them have now been done in humans not for longevity of course because cannot do this for a long time but for weight maintenance for reducing some

00:12:02 signs of aging or reversing those things have been done so all of them have been done in humans mostly healthy humans and in some cases people with pre-diabetes or some aspects of metabolic disease so that led to the idea that that all these forms of fasting in which the total caloric intake on any given day is reduced for one or more days in a week a month that became that umbrella term became intermittent fasting so if you look up the scientific literature most intermittent fasting involves intentionally reducing calories

00:12:45 for at least one or two days in a week or um few days in a month so when we publish time restricted feeding um the initial Mouse experiments and even now most of the mouse experiments we want to test what is the impact of time restriction versus calorie restriction so in these experiments we don't reduce calorie on any day of mouse life so the mice is the same number of calories as the adlibitum FED mice but still they say health benefit so that's why we call it time restricted feeding but since it involves

00:13:26 living without food for several hours for some people which is it can be very difficult the initial experiments was done they were done for eight hours of feeding and 16 hours of fasting that kind of became popular and so that that's why people use the same term as intermittent fasting and now if you say intermittent fasting and popular literature or popular media then people usually refer to time restricted eating so now coming back to how do you define time restricted fitting um so the way we have been trying to

00:14:02 Define experimentally and also in literature is um trying to confine all your energy intake from solid and liquid food combined within a consistent window of 8 to 12 hours because that's something that doable of course people have done time restrictive trading with four hours six hours and some people even try to eat everything within two hours one meal a day um but the point is those are not feasible to maintain for very long time for a lot of people one question about the six hour versus eight hour versus 12 hour feeding window

00:14:45 is it important that the feeding window begin and end at the same time more or less yeah and if so how much flexibility is there so for instance I'm somebody that I am not terribly hungry in the morning I like to drink water usually some caffeine and electrolytes yeah in the period before my first meal and my first meal always lands sometime between 11 and 11 A.M and 12 noon

there are exceptions yeah occasionally I'll have a breakfast a proper breakfast as it's called Uh I guess it would be improper

00:15:19 if you're intermittent fasting for me um but typically 11 A.M or noon is when I first eat my last bite of food is typically around I don't know 39 PM that's what works for me yeah is that consistency affording me any benefit separate and let's just leave aside total caloric number macronutrients plant-based meat Etc but is there any benefit to shortening that feeding window that we are aware of or extending that feeding window or being even more rigid about the start and end of that feeding window

00:15:54 yeah so the start of the fitting window um that's interesting because the concept of time history feeding when I describe animal studies it's feeding for humans it's eating so the concept actually came from the science of circadian rhythm so that means um our body has an internal timetable that's present in every cell in every organ that pre-programs many molecular aspects of the cells that leads to physiology and all that stuff so that essentially there is a predetermined timetable for every cell

00:16:36 every organ to do certain things at certain time and the Circadian clocks as you and I know are more sensitive to light light is the most dominant um time Giver so for example when daylight saving time changes or when we travel from one time zone to another time zone we feel kind of crappy because our daily activities uh out of sync from our internal clock so that was known for a very long time but then around the year 2000 2002 there was a famous experiment by Uli sibler from Switzerland what he did he just

00:17:23 Fair demise at the wrong time mice are nocturnal their night feeders and when he fed the mice during their time and the liver clock instead of following its own routine liver clock actually started following food so that means by changing our feeding time we can change we can tune our liver plot and subsequently the same experiment has been repeated many times and when we repeated that in 2009 and we figured out Yes actually outside this brand Center called Supra chiasmatic nucleus or scn which

00:18:03 is considered the master circadian clock almost rest of the brain even follows when we eat and that came out from Pierre shambon's lab in Europe where they systematically looked at even places that are very close to the asean for those who are who node or some medial hypothalamus or paraventricular nucleus all of this within a couple of four or five millimeters of the scn but they were following food queue amazing so then um and now if we think about it so for example when the daylight saving time

00:18:43 changes just one hour change um or one hour change in alignment between our internal time and external time leads to kind of feeling groggy and filling not out of Peak Performance for one or two days so the rule of thumb is when the time Giver changes by one hour then our internal clock takes at least a day to catch up so that means if you're flying from LA to New York uh you're moving through three time zones then on an average it will take three uh three days to catch up with the New York Times for some

00:19:23 people it can be even slower and for some people it can be two days but the bottom line is yes there is a decentrality so then what does it mean for the body sorry one of the function of clock is to anticipate when you're going to wake up for example so the blood pressure slightly goes up our heart rate goes up our breathing goes up similarly for food almost every organ that is involved in feeding or eating digestion all of them have clocks so even from saliva production that's the first phase of digestion to

00:20:03 secretion of all the digestive juice and the stomach and the absorption of nutrients and liver metabolism everything the whole village expects one you're supposed to eat and they're getting ready for you to eat the first meal after fasting for a long time so that's why it's breaking the fast of breakfast and when that time changes when you change it by two or three hours from one day to another then um sometimes they're like oh food didn't come or maybe um will come at a wrong time we were at the wrong time and then they will track

00:20:40 the new eating time so suppose say one day you have been eating every day at eight a.m um I ate at 8am is that when you start yeah when do you when does your feeding Windows shut uh 6 p.m so I eat for around 10 hours okay um and then one day if I switch to 10 am then what happens is a clerk is thinking well the food didn't arrive at eight but it arrived at 10 maybe tomorrow the food will arrive somewhere between eight and ten so we'll be ready around nine and next day if I come back and eat at eight o'clock then I may eat but my

00:21:20 clock is not ready to digest that food so that's why this idea is you have to be consistent uh to take advantage of this anticipatory activity of our cloth in different systems to get the best out of it is there evidence that those anticipatory systems and as they relate to digestion help us better assimilate our food I would imagine so I mean if you have the gastric juices that are going to help digest the proteins fats and carbohydrates and uh already deployed at the time when you eat I could imagine that food will be better

00:21:52 utilized than if you don't so in other words what is the advantage of having these anticipatory signals in terms of potential health benefits the anticipatory signal is really important from even even from working up um the reason why many people feel not ready completely when they'll wake up to an alarm clock because the alarm clock wakes you up but your body is not

prepared so that slippiness after waking up to an alarm clock is due to our body is not prepared for that and then the best example is when the when

00:22:31 uh the daylight saving time changes particularly when we have to wake up one hour early uh what happens people who have underlying heart condition um when they're waking up when the body is not ready your heart is not ready and all operations from the heart has to start pumping little bit harder then there is chance of heart attack and in fact people have looked at hospital records and that they find that on those days and there is a sharp rise in heart attacks in car accidents and car accidents too because your brain is not

00:23:06 coordinated so you cannot make those fine decisions so that's a great example of anticipatory activity but coming back to digestion one thing is um and this is something that many people might have experienced there are many rhythms in our digestive system and one of the rhythms is our look our intestine has this peristaltic function so it kind of contracts and expands and that moves forward more food doesn't move due to gravity so it goes back and forth and that peristaltic axon actually slows down at night a few hours

00:23:46 after our last meal and um so that's why when people eat late at night for example then that food doesn't get digested because there is not enough digestive juice first thing and second even if it gets digested in the stomach it doesn't move properly so then the next morning people get up and think um of course people consume some alcohol very often and then they think that this is Hangover but those who don't consume alcohol then they have the food hangover because it doesn't digest so that's one

00:24:20 extreme example where food at the wrong time can um so healthy food at the wrong time can be crap or junk yeah I've um experienced that where if I've worked late or I couldn't eat dinner or something and then I get home I always debate whether or not to try and sleep yeah but if I'm too hungry oftentimes it's challenging and so for me sometimes consuming something that at least seems easily digestible like yogurt or something in a liquid form um is better for me than if I eat a meal I've made the mistake of going to the

00:24:53 refrigerator being super hungry and eating a bunch of food at 10 or 11 p.m and then falling asleep and indeed the sleep if I'm tired enough can be quite deep but the next morning I feel just completely physically and and cognitively weighed down so I think what you just described makes a lot of sense so is it so if someone were to select a feeding window regardless of whether or not it falls into classic intermittent fasting time restricted feeding sounds like eating your first bite of food and

00:25:22 eating your last bite of food at more or less the same time each day yeah has benefits I have this question you mentioned feeding versus eating and I think it's actually not just a grammatical uh semantic issue um and here's why we tend to think about when you take your first bite of food and then when you take your last bite of food but of course Foods digest at different rates more fat in there is going to digest make carbohydrates digest slower Etc I mean there's all these adjustments to the glycemic index and so forth with

00:25:55 Foods in combination I is it better to think about not eating but your fed State and blood sugar so for instance I often get asked on social media does blank break a fast so uh and so I like to think about it scientifically like okay is does plain water break a fast no does air break a fast no um does one grain of sugar of sucrose break a fast well probably not but does one teaspoon of sugar break a fast well you could say yes but transiently like so I mean when we're talking about breaking a fast are we

00:26:31 talking about a rise in blood glucose or are there molecular signals Downstream of of a rise in blood glucose that um cannot be reversed in other words if I'm gonna eat my first meal every day at noon and I'm gonna eat my last bite of food at 8 00 pm and at 9 00 a.m for whatever reason I have coffee with one teaspoon of sugar in it I suppose in the strictest sense I've broken my fast but maybe by if I went for a hard run that morning maybe by 9 30 a.m I'm back in a quote unquote fasted state so what is the fasted State

00:27:06 really because when I'm eating at 8 pm just to give another example I'm start fasting at 801 perhaps yeah but I have my blood glucose is elevated so I'm not really fasted I'm fed yeah it's just that I'm not eating the verb right okay so um so again I I don't want to get overly detailed just for sake of getting detail but I think a lot of the confusion out there about what breaks a fast yeah is related specifically to this issue yeah which is if I eat a whole pizza after sitting around all day it's very

00:27:36 different than if I eat a whole pizza after having run a 26 mile marathon that yeah very different yeah um metabolically speaking so how should people think about fasted versus fed can we be mildly fasted versus severe fasted can we be um fed-ish versus very fed anyway I'll I'll uh stop asking questions now because they all relate to the same theme yeah no these are um very interesting question and then unfortunately as you can as you have you might have seen in life the most obvious questions are often unanswered because

00:28:13 it's so hard to do these damn experiments because if you really want to address this in humans you have to bring humans put them in isolation just like you said I can now imagine planning five or six different experiments each experiment should involve eight or ten volunteers it's gender sex and then do it so it's difficult so now let's go back to see how do we let's dissect it in

terms of say indirect calorimetry so for example indirect calorimetry is based on this principle that whatever oxygen we

00:28:50 breathe in and carbon dioxide we breathe out if we can measure these two then we can figure out whether our body in total we are not saying whether it's the liver gut or fat or muscle in total whether it's consuming glucose or fat as energy source the idea is when we fast when we are without food for several hours then ideally our body will tap onto glycogen first and then do a little bit of fat and then when the body is mostly running on fat then that ratio of CO₂ to oxygen will come to 0.7 [Music]

00:29:32 um but what is interesting is we can do these experiments in mice so we can go to mice and ask okay so what happens in mice so and mice mice are a little bit very different because mice are not simply little people they are the metabolism is different they store relatively less glycogen than humans do in terms of total metabolism so they overnight within 12 to 14 hours the rer respiratory exchange ratio or this ratio will go from one when the consuming mostly glucose or carbohydrate as energy source it will slow down slowly go to

00:30:11 0.7.75 it's after 12 to 14 hours they're kind of mostly running on fat so now as we give them food um within 10 or 15 minutes they are not actually consuming couple of grams of food they might have consumed say 100 or 200 milligram of that child so which is less than say five percent of the food and then the rer will immediately begin to rise as if that small amount of food stopped that fat burning process and cranked up the carbohydrate burning process when you say fat burning process you mean body

00:30:51 fat stores being burned right not dietary fat correct yeah so it's all body fat means that that's why I said um we don't know where that fat is being burned because we are just measuring how how much mice is breathing in and out um so for example it can be from the Skin So subcutaneous fat or belly fat but not dietary fat no by that time the dietary fat is already absorbed and digested and hopefully it's sitting in the liver or adipose tissue somewhere but it's the fattest body fat yes thank you yeah the reason I ask is that

00:31:24 nowadays I think more than half of the battles about nutrition that I see online relate to this issue where I won't name names but someone will come along and say low carbohydrate diet allows you to burn more fat and the more nuanced people out there will will say well that's true but you're also talking about dietary fat you know the word fat can confuse people I realize you're not doing that you are certainly not one of the people guilty of doing this but indeed you eat more fat you'll burn more fat but that

00:31:51 doesn't mean you'll burn more body fat in fact I think the day does say that under conditions of caloric restriction you'll actually burn less I hope I don't I'll probably get I'll probably get um pitchforks uh through the mail toward me on on that one but but I think that's true whereas you know people who consume carbohydrate can still burn body fat even though the majority of the fuel they're burning is from carbohydrates so yeah so here in this case for example from mice we know that as soon as they

00:32:17 start eating um the area goes up coming back to your question what would be ideal for us to do the experiment would be okay so we'll go back to that and then give the mouse maybe 100 milligram of food and Mouse runs around in the case and then we'll continue to measure to see how long it takes for the mouse to come back and then so that's one husband so now let's say um let's stay on this and then I'll come back and talk about non-caloric food and whether that is considered I'd like to take a quick break and

00:32:52 acknowledge one of our sponsors athletic greens athletic greens now called ag-1 is a vitamin mineral probiotic drink that covers all of your foundational nutritional needs I've been taking athletic green since 2012 so I'm delighted that they're sponsoring the podcast the reason I started taking athletic greens and the reason I still take athletic greens once are usually twice a day is that it gets to be the probiotics that I need for gut health our gut is very important it's populated by gut microbiota that communicate with

00:33:20 the brain the immune system and basically all the biological systems of our body to strongly impact our immediate and long-term health and those probiotics and athletic greens are optimal and vital for microbiotic health in addition athletic greens contains a number of adaptogens vitamins and minerals that make sure that all of my foundational nutritional needs are met and it tastes great if you'd like to try athletic greens you can go to athleticgreens.com huberman and they'll give you five free travel packs that

00:33:49 make it really easy to mix up athletic greens while you're on the road in the car on the plane Etc and they'll give you a year's supply of vitamin d3k2 again that's athleticgreens.com huberman to get the five free travel packs and the year supply of vitamin D3 K2 so there is a famous experiment that was published last year by jotakahasi Islam and it came out in science and that relates to caloric restriction and we kind of started with this idea we started to discuss on that the rat experiments were done with caloric

00:34:23 restriction and researchers get reduced calorie consumption by 20 or 30 percent and get that food the rats and then subsequently mice and they all lived longer what is interesting is in all those experiments the researchers came and gave this bolus of food at one time whereas the adlibitum FED mice or rats they had access to food all the time so they're eating all the time and

then these rats were given 20 percent less and what happens is this mice or rats then I'm going to take that less food which is restaurant now and just eat

00:35:05 little bit of lunch and then snack after three hours or snack after three hours they double up all that food within two to three hours maximum four hours food is gone so they're sort of on the omad diet the one meal a day yeah they're almost like in one meal a day three to four hours food is gone or you can sit there on four hours eating or feeding and 20 hours fasting um so then the question became well the benefit of caloric restriction as we know is it due to reduced calorie or time restricted feeling or timing there

00:35:43 is a timing component to it that they are eating all of that within three to four hours and then there is a long fasting and this is a difficult question to answer because now you have to ask this poor grad students or technicians to come and split that food into eight or ten or fifteen different small portions and then give them to mice in every two hours who actually published the first paper in 2017 showing that most caloric restrictions I mean he used the protocol that was used by Kelly restriction field

00:36:18 it actually creates a condition of time restriction so he saw that and then he went back and worked with Engineers to come up with the smart kids where he could actually tell he could program how much food is given to mice at what time of the day or night completely programmed so then he took this uh for example suppose say the adlibitum FED mice it's five grams of ciao in a day and if you want to reduce calories by uh 20 percent and the CR Mouse should get four grams of food and it divided this into

00:36:59 9 or 10 meals and then give them in every 90 minutes so in this case they're eating small meals throughout day and night so there is no fasting so you can say that well this mouse actually is not getting into fasting because in every few hours is getting some food and then he measured how long the mouse is going to live um and he used um accountments this is a very standard protocol people count how many mice have dying on which day and then examine them to see whether they've died because they

00:37:35 there was an accident or they actually there was a natural cause and then they calculate at the end what is the half life so 50 survival because that's on an average that's a good indicator because if there is an outlier that will live for a long time then that can skew so what was interesting was the limit unfair mice of course they live certain number of days and then this caloric restricted mice that never got into Super fasting but kind of eating snacking throughout day and night that also lift 10 percent

00:38:12 extra 10 percent longer so that means caloric restriction extended lifespan by 10 percent I've wondered about this because recently you know there's been there were a bunch of news headlines about intermittent fasting and and frankly I was frustrated if you looked at one major news outlet they would say time restricted feeding affords no additional benefit Beyond caloric restriction for weight loss yeah then another popular press venue let's call it that same study described as time restricted feeding

00:38:49 doesn't work yeah right and then another one maybe someplace um even more extreme you know time restricted feeding um only beneficial because of caloric restriction or something like that so what you've essentially got are three different interpretations of the same data all of which are well two of which are true one of which is false in my opinion but what I think people take away from that is oh time restricted feeding isn't valuable which is not the case it I think for many people it's a convenient way to eat because at least

00:39:20 for people like me it's simpler to designate between portions of my day when I'm eating and portions of day my day when I'm not eating as opposed to eating portion control for other people portion control can work but all of that is related to either maintenance or loss of weight none of it deals with the potential health benefits independent of weight loss yeah right so um and so I I think that um if we can segment those out um obviously in humans it's hard to know if a given treatment or experiment is

00:39:52 extending life because you don't really know how long people would live anyway yeah right whereas with mice you have some sense of when the mortality was likely to occur so what can we say about time restricted feeding and longevity in terms of biomarkers or in terms of any other indication that people who start and stop their feeding window at a consistent time somewhere between 8 and 12 hours per 24 hour cycle are tilting the scales towards living longer as opposed to living shorter this example of this news article that you

00:40:24 mentioned is really interesting because that relates to Joe's Joe takas's study because I described that if you split calories and eat throughout the day throughout day and night then the mice lived 10 percent extra but if you now give Mouse the same caloric restricted diet and fit them during day time whether within 12 hours or two hours then the mice lived 10 percent extra beyond that yes so twenty percent so okay so let me make sure I understand so that uh so that I make sure I understand if you take a certain number of calories

00:40:59 and you distribute them throughout the 24-hour cycle yeah it's caloric restriction the mice will live ten percent longer yeah if you however restrict that to the active cycle of the so for humans the daytime then 20 then they live 20 percent long twenty percent so it's not just total caloric intake yeah meaning it's not just important to be sub maintenance and calories for sacral

longevity it also is important as to when in the 24 hour cycle yeah you eat those calories do I have that right so now

00:41:33 that's still the story is not over because this mice were fed during daytime and they're not supposed to eat that's right so for us it will be the equivalent of being on the night shift and only eating at night but a sub color sub maintenance calorie diet I guess is the right way to say it but when he fed mice during night time when they're supposed to eat and they're seeing this getting the same number of calories within 12 hours or two hours then the mice left 35 percent longer than they control 35 longer so scale to

00:42:04 human lifespan which you know we don't know but but a 35 longer would mean that um and again no one knows but um humans now what is the average mortality in the United States yeah so it's around 80 it used to be 18 hours slow uh reduce little bit because of covet but let's take 80 okay so people are then now living somewhere between 25 and 35 years longer but I'm putting some error bars on yeah yeah so that was um really profound but now you pointed out um biomarker and other stuff so now if you look at any given time within

00:42:41 that experiment and actually Joe went back and um had a separate cohort of mice very similar and so that he could take tissue samples and of course in this case you have to sacrifice the mouse and he looked for um he did a lot of molecular analysis with non markers for example hemoglobin A1c equivalent or glucose control cholesterol all this stuff he could not find anything [Music] that predicted the benefit of caloric restriction so that means in this experiment whatever we know so far the predictor of longevity none of them

00:43:20 could predict whether this um CR only Mouse which throughout day and night that Mouse is going to live less than the night fed mouse that was going to live 35 25 extra does that mean that there are biomarkers related to longevity that we just haven't discovered yet yeah so that's exactly so that means whatever we know so far about biomarkers those he could not use to predict maybe there was a lot of noise maybe he wanted he had to use more number of mice to get that because you know biomarkers are not going to predict in every

00:43:58 instance so there is some error what is also very interesting is if you look at the body weight and body composition of all these mice there is no difference in body weight and body composition across all these differences all these groups so it doesn't matter when they ate yeah provided they were submit sub maintenance calorie intake so less fewer calories than is required to maintain their weight didn't matter what pattern of eating they were the same way yeah so that in many ways seems to mimic

00:44:27 the human studies where they say look it doesn't really matter whether or not you use caloric restriction or or you start your feeding window in the morning or start your feeding window in the evening or you um or you portion control for sake of weight contr weight loss because you're taking a snapshot of that and then another thing with the human study that we are referring to here um that in that human study people are actually already eating within 10 hours window habitually when they selected these

00:44:58 people to have them enroll in the study so they were already eating for 10 hours and fasting for 14 hours all participants had to reduce that caloric intake and they reduced by almost 25 percent the CR group continued with 10 hour sitting window and the CR plus time restricted group had to eat the same number of calories within eight hours so it's just a two hour difference it's just a two hours difference okay so that people I just want to make sure people can understand so in this human study which is the one

00:45:29 that I felt that the popular press venues all except one venue um got either semi-rung or badly wrong in terms of their conclusion that was my interpretation anyway was that either people came into the study eating basically in a 10 hour feeding window which goes back to my first question which is that most people are not eating in the middle of the night yeah or if they're on shift work and they are then they're sleeping during the day anyway so they're eating in a 10 to 12 hour feeding window anyway so you're saying

00:45:54 they either did caloric restriction portion control within the 10-hour window or another group within the study eight sub maintenance calories so caloric restriction CR as we're calling it the acronym CR but restricted to that to an eight hour feeding window and they didn't see any difference in terms of weight loss yeah but but it's not all that surprising right I mean if it's just a two-hour difference yeah exactly so we have done that experiment in mice and we don't see um difference in not only weight loss

00:46:23 many other markers and I was telling you about this um paper where I told you that he allowed this mice to eat within two hours or 12 hours sub calories diet 2 or 12 2 or 12. yeah that's dramatic but still he did not see change in longevity even within those two so that means um when you do caloric restriction and then at least for months and you are within 12 hours window um that's that is giving the mice the best benefit the optimum benefit and um two three or five or twelve per Mouse doesn't matter at least for longevity

00:47:05 can we conclude for humans that whether or not a feeding window is four hours six hours eight hours or 12 doesn't matter provided that calories are are similar or same well I won't go to that extent because we don't know many of this particularly we don't know how this sort of eating window will affect both success because you know we always think many of this mouse

experiments even that I told you about those are done only in Mel mice but that should be changing right because the NIH I know this because I'm on study section

00:47:38 which is just a bunch of people who record who review grants is that every Grant now has to include sex as a biological variable it's hard to get away with um or rather I should say it the way it should be said which is people are required and should want to look at these phenomena in male and female mice yes especially if there are differences so in this case um there are many I mean there is also another paper um in time history repeating that also came out a big paper showing that they um thermogenesis was accounting for loss

00:48:14 in fat mass and time just to referred mice that was also done only in male mice um so this is um we are paying attention to it so we are now doing all of our studies in male and female and we do see big differences between male and female coming back to humans what typically happens is when you're trying to do four hours or six hours of time restricting people will inadvertently reduce their caloric intake yeah just because of gut volume I tried one meal per day and and I felt like I was eating so much at that one

00:48:46 sitting yeah that it led to a lot of gastric distress and I got tired after the meal and part of the reason I like to do time restricted feeding is I have more energy yeah and certainly in the fasted State I feel more energized especially if I'm ingesting a little caffeine or something like that um so people will reduce um energy intake and then some people who are more active they can actually unconsciously they may be spending more energy in their physical activity and basal metabolic rate all of this

00:49:17 combined than homozygous eating and that can have a very adverse effect in long term because we know that this energy deficit and in fact there is a scientific term for that it's called red S relative energy deficit in sports energy deficit in sports okay yeah it's because nearly 40 percent of athletes um not the NFL guys but you know a lot of people who do track and field um and nearly 40 percent of athletes actually experience this Reds red S without knowing can male and female athletes both men remains Reds so it's

00:49:56 Reds Reds relative energy relative energy deficit in sports interesting is the first I've heard this acronym we have a new acronym folks this is good to add to it a list of other acronyms but I so males and females can experience it so in females I've heard that um Reds um can lead to uh amenorrhea so loss of of men's of the menstrual cycle yeah so that's uh so common that uh so prevalent that in fact many women many female athletes they take it for granted that yes if they are more active then they

00:50:32 will lose their menstrual cycle which is which may be common but it's not normal or Optimum per health and even if they don't want to get pregnant yeah yeah yeah yeah we had an expert on female hormones come on and say the very same thing that regular cycling is a is very important of ovulatory menstrual cycle is is important to try and um maintain yeah yeah so that's one but then what is really concerning is um it does affect bone health and um in this state people actually over a long period of time the loose bone mass

00:51:10 and the bone also becomes more prone to injury micro fracture and fractures um so again it's a risk means if some people are trying to eat within very short time and they're Physically Active that happens and it also has impact on means the reason why these women are losing menstrual cycle is the hpg axis is disrupted hypothalamus pituitary gonadal axis and it starts it may start again Upstream at hypothalamus or pituitary so that means that HPA axis hypothalamus pituitary and adrenal axis may also get

00:51:50 disrupted one of the symptoms of Reds is also depression anxiety bipolar like symptoms and we know that many um many athletes experience that we think that well this this may be just peer pressure that always trying to compete and we know that I'm unfortunately there are few authors who just can't cope it and there are many attempted suicide or suicide so this is a serious issue and there's also another new topic in the lab to come up with a mouse model of Reds and then study it but this is one

00:52:24 risk why we should not reduce our eating interval to two such to one meal or very short time because it can have adverse side effects that we don't know now um maybe in future we'll figure out when we systematically study them there are studies that are published showing four hours and six hours time restricted eating has benefits on weight loss but those are on healthy individuals and they were in the studies so the um you know the study team took a uh well already monitoring the mature that there was no sudden weight loss or

00:53:01 weight loss below um some safety level uh so those are very different from regular people who are who maybe even normal weight or even with uh within the healthy range if they do then they can potentially so that's why what we think is eight to ten hours maybe the ideal spot to begin with and um once you are physically active and you are also spending a lot of energy in physical activity or Sports you can even go up to 12 hours because in mice we have done that experiment um after 12 hours they do get a lot of

00:53:38 benefits not all but so this is 12 hours of 12 hours of feeding 12 hours of fasting yeah um in humans um again nobody has done systematically 12 hours but there is one study in Europe um from tin High Colette lab and Tin high and I we collaborate so they used our my security and clock app this is a research app we developed just to this is mostly used in time restricted eating

studies and he had nearly I think he started with 200 Swiss participants but then at the end he selected and took very small

00:54:14 number of groups people who are very um meticulous about recording all their food and divided them into usual feeling whatever they wanted to eat whenever they wanted to eat and they were given the advice of Swiss nutrition advice that's given to improved health and reduce blood glucose almost like diabetes prevention program in the U.S and then the other group was given advice to eat within 12 hours this is very early on in time restorating and we thought that the mice were getting some benefit let's try with

00:54:49 the 12 hours has any benefit the bottom line is at the end of three months and six months what he reported is both groups lost same amount of body weight and then there's not too much significant difference between groups but both groups actually improved their health so the bottom line is the Swiss nutritional advice that he was giving Which is the standard of care there it achieved the same amount of weight loss as just giving people this advice that eat within 12 hours so one way to look at it look at the result is like this

00:55:27 and then he went to more extent and actually looked at every single meal these people consumed so they're close to I think close to 60 or 70 000 meal records and pictures he went through and then classified them to say whether these are good quality food so they call it the Nova classification one two three four one is the food that you can almost eat raw fruits vegetables um yogurt and dairy products that you can almost without any preparation and then second Nova 2 is kind of home home cooked food that most people will

00:56:06 prepare in few minutes and then three and then fourth one is the food that you can never prepare at home so for example biscuit or cookies that we usually purchase and few other things and usually the Nova 4 are unhealthy Ultra processed food so which we should not be eating so the advice is to reduce Novak for and what I found was people who got all this advice um to improve their nutrition quality they actually improve their nutrition quality they reduce their Nova for food and people who were in time frustrating

00:56:42 the eight within 12 hours they did not change the nutrition quality but what is interesting is they both got the same modest weight loss so that begs the question that in the maybe tin high will do this experiment again to combine nutrition advice with time restriction and maybe reduce the time to 10 hours and that might help um so 12 hours is something that I say anyone from five-year-old to 100 year old can do and if you are trying to maintain weight that might be a good way and combine that with exercise it'll be

00:57:20 great and and people can more easily avoid Reds in that way women and for non-athletes or recreational exercises sounds like women if they distribute their calories across 12 hours are less likely to lose their menstrual cycle yeah so again this is something that we have to look carefully they have to be because we do have the my security and clock app that many people download and self-monitor and they share the data for researchers we won't provide a link to that by the way it's a great it's a

00:57:47 great tool yeah but once in a while we do get this input from some women saying oh I started doing your Timeless routing and I I'm seeing all these problems and then I ask them okay so what else are you doing they're typically improve the nutrition quality so they're eating only salad and few and they're trying to increase the fiber intake and it's really hard to eat so much of uncooked food because cooking helps to absorb more nutrient and then at the same time they're running five miles every day and

00:58:16 of course all of this combinedly can lead to Reds like symptom so that's why 12 I think is a good point if you're combining physical exercise and better nutrition quality because in mice also we have seen that if mice are eating healthy food and they're eating within 10 to 12 hours then they also live longer than mice that writing healthy food but Distributing that calorie over a long period of time and this is um Rafa di cabbage finding from NIH he has systematically done this study with two different types

00:58:53 of diet and in mice and he finds the same thing that even mice that are eating within 12 hours they do live longer than mice that eat randomly even healthy food I I recall a recent study I think it was either published in cell reports or cell reports medicine forgive me for not remembering which we'll both of course cell press journals excellent journals which explored time-restricted feeding in the context of low carbohydrate or non-low carbohydrate diet so it was low carbohydrate versus low carbohydrate and

00:59:24 time restricted yeah so these all caloric matched right between groups and then non low carbohydrate diets those are more standard uh I think it was somewhere in the neighborhood of 60 of calories from complex carbohydrates and and as I recall the um the greatest weight loss remember same calories across groups folks um was achieved with low carbohydrate plus caloric restriction yeah um and I wondered why all the popular news venues didn't cover that study um but that's why I'm bringing it up now I

00:59:56 thought this is really interesting and um and I'm somebody who's cycled low carbohydrate diet um before I find it hard to sleep after about three or four days of being on a low starch yeah diet just personally I so I like to eat some starches yeah especially if exercising intensely or working intensely that's just a little editorial there that um but look I know many people

who do just feel better on a low carbohydrate diet but what do you think of those data because it speaks to the idea that okay

01:00:24 it's not just the total number of calories it's not just the quality of those calories it's the timing of those calories and maybe carbohydrate restriction in conjunction with time restricted feeding might be the best path for people who are looking to lose weight no I totally agree that when it comes to nutrition quality quantity and timing all these three matter nearly 40 percent of people who maintain healthy body weight because sixty percent are overweight and rupees 40 percent of maintaining healthy body weight and out

01:00:56 of those 40 I would say nearly majority of them are very aware about how much dieting and what quality of food they're eating so you're really an optimist you're looking at the 40 of the glass that's uh or should we say not full there was a pun intended but the um no it's a very interesting way of looking at rather than saying you know why or 60 of Americans obese uh saying why are 40 not obese that's a very interesting way to look at it yeah I mean um subconsciously we're always making the decision inside no means I'm sure that

01:01:30 you are not going and eating um cheeseburger every day because um you want to improve yeah right no yeah exactly I wouldn't feel good yeah I enjoy a cheeseburger now and again but I um no not certainly not this stage or any stage of my life I think that um I think people actually you think the pandemic had a lot to do with this I think that people started to take a look at what they were doing to support or not support their health generally yeah I know people gained a lot of weight during the pandemic other people got really into

01:02:00 fitness I've seen some colleagues but you've always maintained um you've always been in good shape actually the first time I've seen you in a while you've seem to have aged backwards so you are a poster uh for your own um ideas and hypotheses about time restricted feeding but but I um I noticed that during the pandemic a number of people emerged from the pandemic in better shape other people in much worse shape it seemed like it was a it was like a bimodal distribution there yeah um so yeah I get the sense that starting

01:02:29 and stopping eating at more or less the same time each day even if caloric restriction is not the main focus yeah has additional benefits um can we talk about some of those benefits as they relate to the other things that impact health so for instance if you're starting and stopping eating at more or less the same times each day are you sleeping better are you getting more predictable uh shifts in alertness and sleepiness like can you predict when you'll feel good enough to exercise yeah maybe we

01:03:01 could talk about that because you of course um are well known for time restricted feeding and the science around that but also other things as well um not the least of which is circadian biology generally so I always think of the main timekeepers for our system being feeding light activity and social connection did I miss maybe temp and temperature yeah yeah so how do these combine with one another and using timing that we begin and stop feeding is kind of an anchor Point can we explore that a little bit

01:03:30 yeah so you know we got into this um beginning and end and then we you asked for the calorie how much calorie will break the fast um one thing that I want the listeners and viewers to bring back to this timing of when wait when you're breaking the fast because we equate Health with weight body weight and that's when you know we are talking about nutrition quality and quantity because both of them have impact so now let's think about mental health because a lot of people do struggle with mental health they have

01:04:09 anxiety or depression and also um it's a gut health because there are a lot of people who also have acid reflux or heartburn and we know that acid reflux or heartburn can be exacerbated by caffeine intake in empty stomach those who have acid reflux or heartburn they're prone to that then having black coffee in the morning before any food um Can upset their stomach so that's why in those cases it's very clearly that caffeine for them becomes the trigger and that's something the food is supposed to come and then the stomach is

01:04:50 not seeing the food so it's overreacting producing excess acid and that comes up to the esophagus and that's what they're experiencing so if people have that kind of condition then maybe they should consider when they drink their first coffee is breaking their overall fast or kind of putting them putting their health at risk for acid reflux the other thing is people who have anxiety panic attack we know that caffeine can judge you up especially on an empty stomach especially on an empty stomach so for them again

01:05:26 caffeine can be a trigger so that's why I want to kind of differentiate that there is this mental health and other aspects of health and these are two clear examples where anxiety panic attack related to brain health or acid reflux related to our gut health in those cases when we consume that caffeine in the morning can affect so do you avoid caffeine in the morning no actually here is the interesting history about caffeine and this is something I did not know and I was once invited to this history of nighttime activity and maybe

01:06:09 we can take a little bit of detour and talk about night time activity because that fascinates me as a circadian biologist because over the last 200 000 years means we assume that humans Homo sapiens evolved 200 000 years ago so we have been as a species we have been living on this planet for 200 000 years and only in the last you can say a couple of thousand or five

thousand years when we came to control fire or maybe you can even go back to 100 000 years there is some debate um so then the question is well

01:06:46 when you control fire and we light it up the fire and we could light up whenever we wanted we can add Fuel and we can stop the fire when we don't want it that's the key ability in humans that differentiates them from all the other spaces no other species we can always say yes there are signs of this intelligent decision making for example we know many crows can make decisions many many animals they kind of figure out strategize how to get food but controlled use of fire is something very specific to Human

01:07:29 and when we started um controlling fire fire did not essentially extend the day because fire created a evening that is very different from what people did during the day and what people used to do during day they worked a lot means Gathering food was almost everything that we did and so in the evening after the after the after we brought food mostly tubers or maybe lentils to cook or once in a while animals so that we can we could barbecue um all of these things happen around Fire and Fire was so expensive that it

01:08:12 was mostly communal fire so if you go back to for example Maasai and all this and such sorry populations that have no access to electricity and are still living kind of that historical life fire is a communal event and they sat around the cooked food and then what happened they did not talk about work they talked about um culture they told the sang the danced they strategize um that's how politics started philosophy started science started all of this things that are very unique to human civilization started around

01:08:51 fireside chat so um in that way if we think about it we are still doing fireside chat the only thing is we have the microwave and the television or social media so now we chat with our thumbs right so it's still so we are hooked to that evening activity because that's when we are completely free from the pressure of the work and we want to express ourselves that's our independent kind so that's why most people find it very difficult to do time resulting and stop eating at six o'clock because it's in Grand in our in

01:09:26 our even DNA that we want to eat and socialize in the evening so now let's fast forward and see what is the roll of coffee in this and if you look at Coffee consumption particularly Cafe where people can come and have little bit of coffee and socialize it also started as an evening activity and this is an um now we can go back to Istanbul because that's one place where Coffee Cafe is started in mid 16th century so we are talking about 15 40 to 1570 um and that's when uh I'm sorry I'm forgetting the name of

01:10:11 historians who actually invited me and uh okay his name is I must be butchering the name but I'll try to provide the spelling and the wonderful thing about social media is somebody will tell us on YouTube the proper pronunciation so it's a great opportunity if you know the proper pronunciation please put it in the comments on YouTube I'm actually I'm even checking right now in my endnote library it's not picking up that that's right we'll provide a link yeah so what happened was um so coffee was introduced and

01:10:45 um people came and drank coffee and talked about politics at night at night at evening and it actually started with with Sufi branch of Islam because they are the ones who uh consumed coffee in the evening and this is the branch of Islam where they actually sing and dance and all that happened in the evening so singing dancing by the stupid and then here in Istanbul people started congregating and having um talk about politics but then around the same time um some you know in Turkey there was a good sizable

01:11:26 number of Muslims who have to do five prayers a day number of prayers at set time the first prayer is very early in the morning and then they figured out that if they wake up and immediately have coffee then they can stay awake for the first prayer and in that way they felt pretty good and they woke up I said that's how it started as a morning drink to stay awake and kind of get get on with the day but what happened was I don't know whether you have ever tried Turkish coffee it's very thick yeah a few years ago right before the

01:12:02 pandemic 2019 I traveled to Turkey is first of all the food is amazing the coffee is indeed very very thick yeah and I have a pretty high caffeine tolerance yeah um from drinking so much coffee in yerba mate over the years and still do I really enjoy it but um yeah it's it's very intense and so what you're saying is that um coffee intake started as a way to extend into the night the ability to extend into the night at all was because of the ability to harness fire and then coffee stimulatory properties were

01:12:37 leverage toward morning which is essentially like the way I think about it we did an episode on caffeine and some uh someone else Michael Paul and not I described it this way that you're sort of taking a loan out on your energy bank account with coffee you're suppressing the adenosine system the density makes you sleepy but that adenosine system will kick in later so you're you're it's a credit card of sorts with an interest right right and the interest being um an energetic lag that you're going to

01:13:04 experience in the afternoon yeah but what happened was with the strong coffee um that gave heartburn and acid reflux to a lot of people so then they started eating something with coffee and that's how the culture of breakfast started in Turkey ah so coffee actually led to the development of breakfast not the other way around and that uh yeah so that's very heartening uh no

again no pun intended uh for the uh the caffeine lovers Among Us uh which I count myself one of those so essentially the food before coffee

01:13:40 became breakfast so you kind of give something to your to your stomach so it's busy digesting that and then when the coffee comes in it's not reacting to coffee and creating um acid reflux so it wasn't this fascinating so it wasn't that breakfast is necessary on its own it was essentially a buffer against the gastric distress caused by caffeine at least in that culture when in that context um we cannot say that whether the same thing happened in all over the world where coffee is not consumed but still

01:14:12 people eat something in the morning you said you start your um first meal uh of the day at around eight what time do you wake up I wake up around six if I started to six what time do you have your first caffeine no actually I have so that's why I brought up this story because I have coffee after my breakfast fantastic I'm a big proponent of delaying caffeine intake for a few hours after waking for other reasons that my listeners have heard me talk about endlessly so I won't bother with that now but I think um

01:14:42 allowing the suffice to say that allowing some of the natural waking up signals to occur and using light to kind of clear away and adenosine to further extend an activity is better than using a stimulant but until a few hours later this is fascinating because I've never thought about the link between extension into the night socialization or socializing rather feeding and caffeine I'd like to take a brief break and thank our sponsor inside tracker inside tracker is a personalized nutrition platform that analyzes data from your

01:15:16 blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate and long-term Health can only be analyzed from a quality blood test the problem with a lot of blood and DNA tests out there however is that you get data back about metabolic factors lipids and hormones and so forth but you don't know what to do with those data inside tracker solves that problem and makes it

01:15:41 very easy for you to understand what sorts of nutritional behavioral maybe even supplementation based interventions you might want to take on in order to adjust the numbers of those metabolic factors hormones lipids and other things that impact your immediate and long-term Health to bring those numbers into the ranges that are appropriate and indeed optimal for you if you'd like to try inside tracker go to insidetracker.com huberman they have a special promotion right now through Pi Day March 14th

01:16:10 where you can get 31 off their ultimate plan this is their biggest promotion of the Year again if you go to insidetracker.com huberman you can get 31 off their ultimate plan now actually I'm kind of um speaking what many other researchers have found and this this particularly this fireside chat I'm forgetting again the name of the scientist I think is from University of Washington Seattle she went to Africa and kind of recorded what people are talking of course you could not understand what they were

01:16:42 talking Twitter and whether or not Tesla's stock is going up of course no no just just kidding folks and then came back and tried to translate and then figured out that what they're talking during daytime and in the evening were very different so um so so uh what are they talking about at night so exactly so this is like they're talking about matchmaking and talking about politics and strategizing to gather food or or even singing and dancing uh so this is um if you think if we think about it how

01:17:18 we manage sunset to our bedtime what we do between Sunset and bedtime affects most of our health I'm going to think about that for a moment I totally agree um and by the way I'm a huge believer and and I'm in living in great hope for the idea that right now I do think that scientists understand a lot more about the different stages of sleep slow wave sleep REM sleep Etc then we do active waking States like we talk about being focused or being alert but that's not those aren't scientific terms as we know

01:17:55 but I do believe and I've noticed a distinct difference between the first eight hours of the day in terms of cognition and we know that the catecholamines are at much higher levels plus court is also dopamine cortisol epinephrine all of that is really at much higher levels than in the later evening and so this evening time it all it's certainly in the context of mental health we know that morning and evening we are basically different creatures yeah yeah so that's why I think in the evening if you think about it um

01:18:27 again this is uh again another set of research from um my good friend Horacio who the Iglesias yeah oh yeah yeah I'm a big fan of horacio's another he's a fellow Argentine so occasionally we riff about things related to that but he's a wonderful biologist are you guys collaborating yeah his kind of uh I say he's very humble and it's a low profile but he does amazing amazing research totally agree he does research that um we want to know but nobody is ready to do it because field research is very

01:19:01 difficult to go to the Wilderness or go to the places where there is no electricity and then record um when these people are eating sleeping or in this case activity exposure to light that's what Horacio has done and uh it was this active watch which is kind of a modern activity tracker um but it's a little bit more refined because it also collects light information what I found was most of

these Argentinian Towers who have no access to electricity they consistently go to bed somewhere between three to three and a half hours

01:19:40 after Sunset so this is very important because we always think that um our ancestors when they didn't have electricity as soon as the sun went down they just went to sleep no the fire extended the evening so they were staying awake for three to four hours kind of um you know decompressing themselves that we say and then doing all these activities cooking sharing meals and then they would go to sleep and if you look at the slip onset variability it was very small like they're going to bed almost within 15 to

01:20:14 30 minutes standard deviation so no night owls versus morning people exactly so we'll get to that none of this this uh I get attacked by for many reasons it just goes with the business I'm in of being public facing these days but every time I talk about viewing sunrise or low angle sunlight you know getting some sunlight earlier someone says well I'm a night owl and they just it's almost like a protest of trying to protect identity it's become this ideological I I identity related thing I'm a night owl

01:20:47 I'm a morning person and I'm not but you're telling me that in these cultures where there is intellectricity but there is fire people are going to sleep within all of them within about 15 minutes of one another yeah so there is no such thing as a night owl or a morning person in the context I still actually I asked him pointedly because uh uh and then he said no he has not sinned and says dragged hundreds of people and if we ask there are many many sleep researchers or at least the public facing sleep

01:21:17 Physicians or experts they will say yeah we can say one third of people a night hour one third of morning and then one third are in between but yeah they call them like Bears wolves and you know and I'm not being disparaging of that idea I think people really do feel as it as if they Orient towards one pattern or another when I was an undergrad student I never went to bed before midnight and actually midnight was my going to bedtime exactly like 11 45 I'll try to get ready to hit build and then by 12

01:21:47 I'm in bed and I used to get up at six six fifteen that's a pretty short sleep with an alarm of course and but then day time I used to take 45 minutes to one hour nap and that was regular like even if uh whenever I got time of course in college you know you don't have the whole debt unlike in high school you don't have opportunity to nap but in college you can I might have been one of those kids with this hoodie on napping on the desk but they come around and they wake you up yeah but in this case just come back to the dorm and

01:22:18 um after lunch usually I used to take a nap so um then in grad school I remember I rarely went to bed before 2 am and I could have clearly said that I'm a night owl and actually I was a night owl it was very comfortable staying up so late I was very productive doing experiments writing all this um manuscripts mostly and but then afterwards when I looked back in postdoc when I had when we had our daughter um then things started changing because you have to put the baby to sleep and then after the baby sleeps it's

01:23:04 almost when you have a baby your life revolves around the baby so then we have to dim down the light there is no caffeine and alcohol drinking or any other things after the baby sleeps because we cannot do too much noise and others so then I realized that no I'm actually not a night owl and I became kind of more normal because I could go to sleep between 10 and 11. and um that's how I thought well maybe this was very unique to me but what is interesting is I have another colleague good friend Ken

01:23:42 Wright Jr Colorado at Colorado and he also had grad students and um and postdocs like me who strongly believed that there were night owls um just like everybody else and he took Ken took the whole Lab for camping and when they were camping of course there is less light and a lot of physical activity hiking during the day and they all went to bed between 9 and 10 30 p.m I love that study yeah what Sachin just described was a study I think there were two studies uh there were two yeah and um what's interesting

01:24:18 as I recall is that after going camping for a weekend where people awake with this more or less with the sunrise yeah and go to sleep a few hours after Sunset yeah their melatonin rhythms and cortisol rhythms and sleep wake rhythms persisted on that schedule for several weeks despite returning to environments where there was a lot of artificial lighting which I find amazing that just a weekend of consistent rising and um going to bed with the sunrise and sunset yeah more or less allowed a reset that was very long

01:24:53 lasting yeah so um actually even in Horatio study he found that almost all the tobas they wake up around sunrise time and it's amazing when I look at the standard deviation it's like so tight so take that night owl so-called night owls I also in graduate school I would work until 2 A.M I loved it I'd blast music in the lab everyone was at home pretty much not everyone but there were the the night crew and then I'd get in sometime around get up or sometime around 9 30 10 and then get in around 11 and it was no

01:25:26 problem because I was going to stay so very late and then over time I noticed I've become more locked to a standard schedule so I think what we're saying is that the clock can our internal clocks can shift yeah but this idea that we are genetically biased towards one schedule or another may need revisiting that's what that's the conclusion I'm taking from this a couple of

aspects one is um you know some people are genetically so pre-programmed because the other flip side is what is called technically

01:25:55 familial Urban sleep Fest syndrome so these people um you can give them caffeine or whatever but they will fall asleep say at eight o'clock they cannot stay awake till nine or ten and since it's a very strong phenotype in sleep and circadian rhythm field they are very well studied so in fact Louis potashuk and ingwif they were the first one to track one family like this and then they figured out there was a mutation in one of the clock genes period two that clocked in and that mutation um allowed the clock to run in a way

01:26:34 that these people went to bed very early I guess historically given these Fireside Chats those people were probably not contributing much to their political discussion whatever that was decided after they went to sleep is what they woke up into that reminds me because as you were describing the difference between nighttime discussions versus morning discussions is there any theme to what is discussed in the morning versus in the nighttime where people just sipping their eating and sipping their caffeine and just waking

01:27:01 up um but is there are there any ideas about what morning discussions really consistent morning discussions or daytime discussions are mostly about um work and like hunting Gathering or farming all that stuff and even these days that's what we do we you know you go to I go to work and it's mostly one meeting after another and we're talking about how means if you're in different communities and we're solving problems or your students come with questions you have your TA or the office hours all these things work related we're not

01:27:36 talking I mean serious philosophy of unless you are in a philosophy department and you are talking about political science and also we are not singing and dancing so that's why the evening activity even these days are very different and typically the evening activities uh where we express ourselves we express who we are we feel like we are free and um you know you and I we have this academic intellectual Freedom we can talk about our work just like we are talking now there are a lot of people who work for even in tech industry they

01:28:15 may be working for Google and all these big tech companies they cannot talk about their work to anybody else it's all secret it's all secret so just imagine that staying so they're spending more than half of the wake-up time at work thinking and doing work but they cannot talk about that work even sometimes to their own family members so then what happens for them a lot of people also do the same thing like um the person who is going and baking in a restaurant or cooking or the person who is taking trust and driving

01:28:52 or nurses and doctors can't talk about their patients reality yeah yeah and some people just don't want to talk about it it's so stressful they don't want to bring that stress home so that's why I always say that from Sunset until we go to bed during that time we try to find time for ourselves people say this is me time the me time is essentially we want to truly Express who we are or we want to entertain ourselves because on the Fireside chart it's not that everybody was a performer there are also some audience so we

01:29:29 always switch our roles sometimes we are performing and sometimes we are observing so that's what happens with me time I love this so um maybe social media time should be restricted to just maybe a small portion of that evening time because I would hope that people would also interact socially within in the room maybe in a constructive way or maybe you use that for connect with your family members whom you love or you can have some productive discussion or something so it's it's kind of interesting I think it's extremely

01:29:58 interesting because I think again this this conversation about time restricted feeding is really conversation about circadian rhythm and sleep wake activity and human evolution right um so that's why let's go back to this um uh Night Owl because uh we we kind of made a comment that maybe it's not genetic but this is where I'm still wrapping my head around because you know these days there's some J-1 studies where they're trying to look at night owls to see whether there are some genetic Lincolns

01:30:32 and you know sometimes we always think yeah if you take half a million people of course you'll find some low side but going back to this idea that are some people more sensitive to light so that it's likely that the same level of light even in the same household may make some people stay awake late into the night whereas other people are more resistant to light so that they can go to bed early and since light has become so prevalent these days and this tobus story that we are talking about or people going on camping that is we have

01:31:07 removed that light um so there is some um evidence that People's Light sensitivity particularly the iprgc or this intrinsically photosensitive retinal ganglion cell or the simple speakers the blue light sensors in our eyes um there seems to be even one log unit change in sensitivity as measured by pupil constriction so for some people a small amount of artificial light at night could really shift their circadian clock yeah wake them up essentially and then for some it manner yeah I'm very sensitive to light at night yeah

01:31:45 exquisitely sensitive to it oh so then you are like a teenager yes in many ways um I've been told this thank you um yeah I think um I have actually switched to using a red night light but I should be clear not a fancy high cost red light for sake of any kind of infrared simulation but a red party light type light and I find that was based on reading one study that we covered in an episode

on jet lag and shift work which was that it seems to reduce the cortisol releasing properties of light at night

01:32:19 to use redshifted light yeah so I just use a red light bulb I actually travel with one if I go to an Airbnb or a hotel and I switch to red light and I find that I fall asleep and stay asleep throughout the night much more consistently especially in when I'm in New environments which always makes it disruptive to sleep um it's made an enormous difference in the depth and duration of my sleep and um because oftentimes Hotel lights you know in the bathroom you'll turn them on you're just you're just getting beam and

01:32:46 you're right some people don't seem to be bothered by that I I really struggle with that yeah and in fact in Tina's uh right after puberty um there seems to be a I think that's when the teenagers become more sensitive sensitive to light uh and it's very it's well known that the teenage boys and girls they tend to stay awake late into the night and they can stay up to 12 mid past midnight although they can stay off that lid that doesn't mean that their sleep schedule is reduced their body still needs the

01:33:21 same amount of sleep as other teenagers so that's why they are more likely not to wake up at 6 30 or 7 when we expect them to wake up and go to school um I have a question and I ask every circadian related biologists that can come into contact with this and no one has been able to give me an answer one way or the other but I grew up hearing that every hour of sleep before midnight was of more value or potency than the hours after midnight and indeed I find that if I go to sleep at 9 30 or 10 P.M

01:33:53 I can wake up at three or four a.m feeling pretty fantastic and ready to lean into the day but if I get the equivalent number of hours of sleep starting at midnight I feel like complete garbage when I wake up after five six hours so um is there any truth to the idea that going to sleep Within three hours of sunset is somehow better for our circadian timing mechanisms well um there are a few things one you said that you are very sensitive to light so I assume that you also avoid bright light in the evening as best I

01:34:27 can yeah as best as you could can and then what is happening is with a sense of that bright light your melatonin levels begin to rise so you are prepared for Sleep um of course this is something that we cannot measure because measuring melatonin in every one hour or 30 minutes um is very difficult and there is no consumer fishing product yet so it's likely that your your body is preparing very well under this dim light to fall asleep and when he was trying to stay awake and go sleep at midnight then maybe from

01:35:02 Midnight for the first three or four hours you are sleeping well but then after that your melatonin level might be beginning to fall and it's not only melatonin in your core body temperature and then your heart rate and everything is changing to make you awake but the Sleep debt that you have accumulated is pushing you to be in bed so there is this tension between the Circadian aspect and your sleep depth and unfortunately you cannot have good night of restorative sleep for the second half of the sleep

01:35:35 because of the tension that makes good sense yeah so that's why um you know you are not the only one means there are many people who experience that and in fact a lot of people think that well this may be the way I sleep maybe I'm not um I am not designed to sleep restoratively until you know I sleep one day just like the camping trip and then they realize what it feels like what you're missing yeah absolutely um I want to make sure that we talk about the other aspect of fire which is uh you had a paper that came out

01:36:11 recently very interesting paper studying firefighters and time restricted feeding and firefighters would you share with us the general contour and maybe even some of the specifics of that study because I think it's very interesting for shift workers but for everybody really to understand these results yeah so let's go back to shift workers because um this also relates to all of us because I always say that each of us is a shift worker or has lived the life of a shift worker um and we have experienced how terrible

01:36:42 difficult it is um and now let's start with what is the definition of a shift worker or um shift work like lifestyle there is no Universal definition unfortunately but there are many European countries and particularly if you go to International level organization um then you'll find some references different European countries have slightly different definition which essentially points to if you stay awake for two or more hours during your habitual sleep time and when they say habitual sleep time they assume

01:37:17 that we are just like you said we are kind of programmed to slave somewhere between say 10 pm and then stay in bed and kind of wake up after 5am so the idea is if you stay if you're staying awake for two or more hours between 10 pm and 5 am and you are engaged in some activity whether it's physical activity or intellectual activity you are not lying in bed and wondering worrying about something but actually working so that defines that's defined as shift work and you don't have to do it every single day

01:37:53 even if you do it once a week for 50 weeks then that itself is enough to disrupt your physiology and Metabolism Behavior brain function like a shift worker the reason is as you discussed when you change our external timing queue so in this case when you travel jet lag or traveling across three days three hours of jet lag will take three days to reset similarly if you're

staying awake for two hours extra or if you're waking up two hours before your habitual wake-up time then we just don't get wake up and

01:38:37 then be engaged in some activity in the dark most of us unmends unless you are wearing a infrared goggles we turn on light and light resets our clock so in that way every time we stay up for two or more hours even for one night then for the next two nights our clock is kind of trying to catch up so in that way for three days the day of the disruption and then two days following the disruption um a clock is trying to catch up with the outside time so clock our body is not on time without clock so that means almost for half of the

01:39:17 week or half of the Year our clock is trying to catch up so that's the definition of shift work so now let's come back to Department of Labor Statistics um U.S government um they have not been tracking what percentage of people are doing shift work accurately because there are many difficulties in tracking too but it's generally accepted that one in five working adults is a card carrying shift worker card carrying shift workers means they are nurses doctors firefighters um and Bakers um truck drivers

01:40:00 and many in the service industry so that's one in five so twenty percent of working adults then if we think about all the college students just like I was doing and you must have done um they're also deadlines grants granted lines then we are also experiencing experiencing the lifestyle of a shift worker because we are delaying sleep even if you're delaying sleep by two hours for most of the college students for five days and then the weekend you are trying to catch up that's kind of a security and disruption going on

01:40:36 then you take 1.5 or 1.6 million new months um in the US every year so when the child is born and that mother is a shift worker and actually that mother is worse than a shift worker because um you know you don't know what time of the night the baby will wake up and how many times and there is no weekend in motherhood so they're also living the life of a ship worker um we don't count many food delivery and Uber drivers Lyft drivers are shift workers but they many of them we know that they live so in that way

01:41:17 we think the actual number of people who are experiencing the life of a shift worker is somewhere around 50 percent of the adults population at any given time so that's why it's also another point that you might have heard from people that will say oh I cannot do time restricting because my schedule is messed up or I work in a different way and um that comes into play so that's why we thought um okay so we should try something on shift worker another point is although one in five people are shipped workers they carry

01:41:55 disproportionately heavier burden of disease because almost all age-related disease that we can think of whether it's high blood pressure usually high blood pressure starts in 40s or 50s high cholesterol um gastrointestinal problem in digestion um chronic inflammation of the colon and then even colon cancer in many cases and then of course diabetes all of these are disproportionately more prevalent among ship workers but then when you think about clinical trials whether it's a drug or a lifestyle

01:42:35 often one of the top 10 exclusion Factor criteria is shift work so people who are doing shift work we exclude them from many of these trials one thing is most Physicians and most scientists even people who do shift work they know that they are their body and mind is so messed up that often time even medications may not help them and so that's why we don't try new medication why to take the risk when we know it may not help them and then when it comes to Lifestyle intervention whether it's sleep

01:43:11 extension for example we cannot do because they are supposed to stay awake and do their job we cannot ask them to stay asleep at night and then physical activity and exercise some people can do but some people are so tired after all night that they don't have the energy to do physical activity and then nutrition again most nutrition studies involved the participants to come to the clinic and get um one-on-one or one or attend group sessions and they cannot come and they cannot even sometimes come to

01:43:49 the clinic visit um when people have to take draw blood and in fact there is another caveat that just if suppose I am healthy perfectly normal blood pressure blood glucose cholesterol everything is normal and I live the life of a shift worker just for five nights that means I'm sleeping less maybe four or five hours and even if I don't eat at night time of course many shift workers also feel hungry and just for um to keep their work they eat um just after five days my blood glucose level will read almost like I'm

01:44:33 pre-diabetic wow I actually saw a study in publishing procedures in the National Academy that showed that even a hundred Lux dim Light present in the room while people are sleeping with eyes closed can lead to disruptions in morning uh blood glucose levels in directions that are not good yeah um one night so the the faint clock in the corner or even a a night light that's too bright yeah could be problematic um by the way folks these effects are reversible so I whenever I say these things I we get a lot of comments about

01:45:05 oh my goodness what have I been doing for years but you know kids with Night Lights this is an issue yeah um but what I'm hearing is that one in five people are truly shift workers in the classic sense their jobs require they work at night or into the night and sleep into the day but far more people are shift workers by virtue of the fact that they're Tweeting or working or watching

movies at night even though it's not work in that they're not being paid for that time they are essentially operating like

01:45:35 shift workers if we add those two groups together would we say it's what uh a third of Americans I would say half of America half of America yeah if you take teenagers because you know high school students and college students because again going back to horacio's uh study because Horatio also collected activity data from high school students and college students and we have replicated that with high school students and college students in San Diego so that's Seattle and San Diego and this study now there are many sleep

01:46:06 researchers that have been collecting this data and what we find is um typically the high school students they are going to beds around midnight and college students at least the UCSD students we found maybe one out of 100 who went to bed before midnight that um reminds me that Horacio Iglesias just published this really nice paper um showing that counter to what we believe students now this is the University of Washington in Seattle I should mention where it's very dark in the winter young people see other people in their

01:46:40 20s are staying up later in the winter months compared to the summer months yeah which is you know totally counter-intuitive you think everyone stays up late in the summer and goes to bed early in the winter but because of artificial lighting it's the exact opposite yeah so and another um it's um I don't know whether Horacio monitored it but my other suspicion I'm not saying whether it's true in Winter we are more likely to consume more coffee hot chocolate in the evening and that might also be delaying

01:47:09 slip onset that makes sense so in that way again here is another thing which can be related to policy or practice at Educational Institute so what happened during uh kovid was everybody went to remote learning um the assignments became digital and assignments submission became digital and there are many systems online systems that came into play and by default the assignment submission deadline became midnight so then now what is happening is I don't know about Stanford in maybe when you are giving assignment um one is the

01:47:50 deadline in line typically midnight yeah so then most of us most students they will try to cram as much as possible try to solve as much as possible and submit at midnight and it'll be really cool to go back to your system administrator to see is there so many frequency plot of frequency distribution of what time people are submitting the um assignment because we know means when we submit our grant yeah so I mean you know you hear about the Obesity crisis the crisis of metabolic disorders not just in the US but everywhere in the

01:48:25 world I mean it's really striking I remember going to a keystone meeting scientific meeting in the early 2000s and there was a map of the United States and it showed where the Obesity rates were over 30 percent in adults and the entire country basically was lighting up like crazy now it would be the entire country but there were these kind of zones in the middle um that were almost devoid of uh obesity Colorado namely Idaho at that time those are now also Fallen Under the Umbrella of rampant obesity and you and

01:48:55 everyone is speculating okay is it uh you know is it seed oils is it um is it this is it that is it highly processed foods I'm guessing it's all of those things including lack of activity but one has to wonder given everything we're talking about in terms of metabolic dysfunction late shifted eating all these issues with late shifted eating and staying up late with artificial lighting whether or not that could be one of the major factors in the so-called obesity crisis it's likely you know we always say Freshman 15 that's

01:49:23 right because this is a gaining 15 pounds in their freshman year in college and um this is where I think as executor professors um it'll be interesting to go back and see what can we do because another thing that's also becoming more and more common for example I I give a security under the class means I just give two lectures and I remember when I started 15 17 years ago that lecture used to be around 1 30 p.m or 2 p.m in the afternoon and it's a two and a half hour lecture so it's done by five

01:50:01 and for the last um before the pandemic I realized that they changed the timing now the lecture was starting at 7 pm so I was finishing by 9 9 30 pm and these kids they had to go and eat after 9 30. studies socialize find aside chat fireside chat and then to express themselves like to feel free from assignments what are they going to do that after they submit the assignment then they're going to do that so that's why we have to go back and revisit this issue say okay so for adults for most of us who are working a

01:50:39 day job our deadline is 5 PM in most cases right men's at least an University system the person who is submitting the grant or who is doing taking care of my IRB or I cook they are all living at five o'clock so for me everything has to end by five I think for most people out there so this the race is a kind of macroscopic question which is maybe it's not so much about restricting the feeding window but maybe it's about feeding mostly in and being active mostly in the early part of the day I mean you know I could imagine a Time

01:51:14 three four years from now when it's about when waking up early and going to bed within three hours of sunset is the protocol which harnesses all other protocols right you're going to exercise you're going to do it in that time you're going to eat you're going to do it in that time you're going to socialize you're going to do it in that time and in doing so you're also avoiding a lot of the

issues related to disrupted sleep so that's why all these things I just said Timeless repeating is just one aspect of the security and

01:51:42 health and these are all interconnected and going back to the comment about um within three hours of sunset yes um that's good but then what happens in say Toronto or Vancouver in winter time I guess they're going to bed very very early but also waking up very very early yeah you know one of the things that I hear all the time because I'm always beating on the drum of getting morning sunlight even if through Cloud covers people say there's no sun here this time of year and I forgive me but there is

01:52:10 Sun unless you live in a cave their son is just coming through cloud cover no matter where you live in the world their son yeah unless you live in a cave of course so um I want to make sure that uh we didn't Overlook what was the major conclusion of the firefighters so the reason why we did this study was as I said there are a lot of us who are living the lifestyle of firefighters or shipped workers and shipped workers are excluded from studies so that means whatever we are learning about a lifestyle or even medications that may

01:52:40 be beneficial for people who actually have a normal schedule um but not for people who have a disrupted schedule and if you look up um clinicaltrial.gov there are more than 400 000 studies listed and if you search how many studies are on shift workers it's less than a thousand and then if you ask most of them are to see what is wrong with shipped workers like that's how we know that shift work increases our risk for metabolic disease cancer and even some aspects of dementia but if you ask how many studies are done

01:53:18 to improve the health of shift work alone and that's less than 50 means I mean so I have to go back and check the actual number but it's less than 50. wow so that's why um we got super excited we thought um from circadian rhythm perspective that's something to address so this study again this kind of study is only possible because I'm at Salk and we are affiliated with UCSD and um I can work with UCSD Physicians to do this study so I collaborate with Dr Pam tobb who is the director of cardiac rehab center in UCSD and Pam has many

01:54:00 firefighters as her patients and we both know that the number one cause for death and disability on work for firefighters is not fighting fire but just getting heart attack and stroke uh so they have a very high incidence of heart attack and stroke and they're also highly prone to different kinds of cancer and it may be difficult to ascribe cancer to disruption security and disruption because they're also exposed to a lot of toxins anytime Fire Burns that smell of fire is essentially smell of carcinogens and they're breathing even

01:54:37 if they have the um hood on and respirator they're still good so the idea was very simple we know that firefighters nearly 70 percent of firefighters in the U.S full-time firefighters because there are volunteer firefighters and then full-time firefighters the full-time firefighters 70 of them work 24 hours shift so for example in San Diego they come in at their shift is from 8 AM to 8 am the next day and they do at least in San Diego they do one day on one day off on off four cycles and then four days off

01:55:14 and but in some fire departments they actually do 48-hour shift so they come for two days two days off two days two days off and then four or five days thank you firefighters yeah I mean um so then the idea was okay so we'll screen firefighters and then find firefighters who are metabolically unhealthy and then we'll see whether they can actually follow 10 hours time restricted eating because the point is if firefighters can follow it then everybody else will pay for us with all that stress if they can

01:55:52 and this is again where I should also acknowledge the San Diego fire and rescue Department because without their health we could not have even submitted the grant and at that time David picon who is the health and wellness battalion chief he's the one who actually approached us um because he is very careful he knew that the job that they do makes them weaker and long term and can kill them in long term so he was always looking for new Solutions so he approached us and then we said this is the idea he said well I

01:56:30 love this idea because we are not asking them to sleep more or we are not going to cut down their over time or shift or change the work schedule the only thing we'll be doing is ask them to eat within 10 hours and hopefully we can do this so consistently between the days that they're working and not working yes so that means if they're from 8 A.M to 8 A.M working then the next day then they go home then they're going to eat on the same schedule they did when they were at the fire Firehouse yeah but while at

01:57:00 home so they're not allowing themselves to to deviate from that yeah so we we thought whether they can do it or not because the number one goal or the primary outcome in this clinical trial was feasibility can they do it and then second was if they do it then what happens to their blood sugar and weight and all this other stuff and then we started the study and we hit the next hurdle and that is um you know firefighters are very very tight-knit community and they want to make sure that you understand their

01:57:32 culture and the best way to understand their culture is to live the life of a firefighter so Emily Manoogian who is the first author see and then we had Adina jadurian who is now in med school she was a research coordinator at that time they volunteered they said okay we'll go to the busiest fire station in San Diego and will live the life of a firefighter and the San Diego fire and rescue

and the city they all agreed they reported for duty at 7 30 in the morning they were assigned a bed in the station because all fire

01:58:08 stations do have some beds for firefighters to rest and they have a sign bed so they've assigned a bet um yeah so every time a 911 call chem and if that fire station in that fire station that fire engine was called then just like other firefighters they had to run get into the gears just issues and um a jacket and a helmet and getting the seat and attend the call of course they won't go to this side they just get out of the truck wait there then come back so in that 24 hours MLA got 10 calls at

01:58:44 night that she had to run to but there are more than 10 times the um they got the nine one every time the 911 call came then there is a bit that goes out all firefighters were sleeping or resting they would get up or if they're doing something they'll look up to see which engine is called and interesting so it's not just the ones that go out it's everyone gets woken up everyone gets woken up so that means in a night typical night they're waking up um 10 15 20 times sometimes so they're almost like

01:59:16 um you know new months are like firefighters because they don't have any idea what time the baby will cry and for what reason also they don't know so similarly it's five so that's what Emily did and then next morning once you came back she was like no it's practical seem easy yeah so so then we did the study and we essentially assigned uh all the firefighters we recruited 155 Fighters we assigned half of them to Mediterranean diet because you cannot do any harm you have to give them something good so that's another thing they said

01:59:51 no we want something that we know works for firefighters and there was a Mediterranean diet study so everybody was supposed to follow Mediterranean diet and then have nearly 75 of them were supposed to eat within 10 hours we did not fix the 10 hours because we said um you pick your own 10 hours that you can stick to but it has to be consistent from day to day so if you start eating at 9am you finish it not at uh you know at seven PM pm and then try to be yeah okay try to try to be consistent because

02:00:22 we said yes we understand that there will be some things and you can take maybe half an hour here and there and we'll see how many times you can do it and um what is interesting about although they were all doing 24 hour shift more or less chose to begin eating somewhere between 8 AM and 11 am and they did not skip any meal they had their first meal or what we call breakfast but it was several hours after waking up because they are waking up at five or six and the driving to come to work at 7 30 or 8 and they're eating the first

02:00:59 meal say between 8 and 11. and then the finished meal 10 hours later and what we found is more or less most of them could stick to doing this at least five days out of seven days um and then at the end of the study when we look at their health parameters one thing as I said we recruited everybody who can so that means nearly one in three firefighters were completely healthy they had no sign of any um any illness no high blood pressure high blood sugar or high cholesterol depression or anything so since we have one third of the

02:01:42 population who are already healthy and then everybody has slightly different conditions some have high blood pressure but they don't have high blood glucose somebody has high blood glucose but not high blood pressure so it was kind of heterogeneous so we did not see big difference in weight loss or any wet change between these two groups another thing is firefighters actually run almost eight to nine miles when they're at the job because that's part of their exercise routine but then one thing that changed

02:02:17 significantly in the time restorating group was what we call bldl particle size and particle number because this is something that we know this very low density lipoprotein these are atherogenic and if we can manage them much better and we reduce the risk for atherosclerosis so that's one parameter that changed in the time restricting group even when you combine all healthy unhealthy everybody now if we take firefighters who are beginning with high blood pressure then we saw a significant reduction in

02:02:54 that systolic as well as diastolic blood pressure and the change in blood pressure of course we don't claim that in the manuscript but when we talk about it some physician would get up and say wow that looks like almost there on a blood pressure lowering drug so the extent of blood pressure lowering is equivalent to somebody taking a antihypertensive drug amazing yeah and then those who started with high blood sugar of course we didn't have too many type 2 diabetic but there were a few few pre-diabetic and

02:03:24 they could better manage their blood glucose and this is interesting because once shift workers become pre-diabetic or diabetic they have more difficulty managing their blood sugar than non-shifted workers because the work schedule itself will mess them up too much even if they're on many medications they have difficulty that's fascinating and I I'm really glad that you explained the study in such detail because I would have thought you know from reading the abstract and I did look at the data but if someone were to

02:03:56 look at the abstract they'd say oh firefighters so they're waking up in the middle of the night and they're you know throwing on their gear and going out to calls and doing but if I understand correctly all firefighters are being woken up by the signal which makes the firefighter population a bit more similar to the more standard population who's waking up in the middle of the

night to use the bathroom getting on social media for a couple of minutes or flipping on the lights I mean it's maybe not as severe as what firefighters are

02:04:22 doing um but we know there are blood sugar regulation issues related to those multiple middle of the night wakings especially if people are then staring at screens yeah um so I think it's really important that people were able to hear about the the deeper Contours of the study uh I mean this result of regulating blood sugar better is really powerful I get asked all the time you know I've got a new kid or I'm a shift worker how can I do this morning sunlight viewing um what I'm hearing is that keeping a

02:04:51 regular meal schedule every day at least five five out of seven or as close to every day it's sort of like sleep I always say try and get a really great night's sleep 80 or more of the nights of your life and on the other 20 hopefully it's for fun reasons a great party or something like that or a celebration of some sort um that seems to me a great Anchor Point when one can't reliably control their sleep wake cycle does that mean that if somebody is coming off of shift work and they're very very tired that they would

02:05:23 be better off staying awake and eating than sleeping well it's uh yeah so this is where we get into nuances so here the firefighters are 24-hour shipped workers so that means and they have been working this shift for a very long time so they have figured out and one thing is yes firefighters are different from nurses and healthcare workers who have to work throughout the night and they're staying awake throughout the night whereas firefighters they get opportunity to sleep then even with their pen calls they actually have opportunity

02:05:57 to come back and go to sleep and in fact when Emily and Adina they were in the fastest and what they observed was firefighters after they after attending a call they are not coming back and playing cards or trying to watch the news or get the score they know they will just go back and lie in the bed and switch off the light so whenever they got any opportunity to sleep they would try to sleep so in that way their sleep debt and sleep pressure during day time is not as strong as a night shift nurse

02:06:32 or a truck driver who is driving all night because they have they're staying awake throughout the night so when people say yes you found this and can you extend it to other shift workers my answer is no we have to go back and figure out that's why we went to this station and figured out what would work for them if I have to go and do this for some nurses maybe even I will go or our staff will go and figure out what is the work schedule what happens do they have opportunity to eat do they have opportunity to even take five minutes

02:07:05 break what do they do during break and all of these things come into play but here another thing is um I always said that in other time receipt reading paper we see change in nutrition quality and quantity but here we also saw that somehow both groups inadvertently the improve the nutrition quality because everybody was told to eat Mediterranean diet they increase their fruits and vegetables and olive oil and text slightly and when they had to stop eating early they also reduced the alcohol intake

02:07:44 and this is very significant because many shift workers just to cope with the shift work that tend to depend on alcohol at night and caffeine in the morning so they begin their day with caffeine and end with alcohol and now we can relate that many normal people who are not doing shift work we also more or less begin our day with caffeine and many of us and with alcohol and then when they reduce that 18 to 10 hours and then we saw a significant reduction in alcohol intake in the time restricting group but not in the standard

02:08:22 of care or Mediterranean diet group I certainly support that we did an episode on alcohol and I was shocked when I researched that to learn that zero to two drinks per week is essentially the threshold Beyond which you start seeing health deficits in particular Cancers and metabolic disruption sleep disruption and increased anxiety when people aren't under the influence of alcohol I mean it's a pretty incredible how alcohol has kind of escaped as the the opposite of caffeine and therefore um not a health hazard it's and here I'm

02:08:56 somebody I have a drink every once in a while no big deal for me I can have it or not have it but it's just striking how um alcohol despite extensive data that it can really disrupt Health even at three drinks per week yeah is um is just avidly consumed as if it was kind of like food or caffeine it's really incredible um I I want to make sure that I Circle back to something you mentioned earlier because I know they're going to be a number of people that asked this if I recall you said that provided that the

02:09:24 feeding window is not shorter than eight hours that men women and children can use time restricted feeding um yeah so what I say is um 12 hours 12 excuse me 12 hours thank you for that clarifying um because we did a study that was published in 2015 and again um behind many of our studies there is a story so we are publishing all these Mouse stories and then I would go to conferences and and of course the um some some people would give me a look saying well you must be doing something wrong we this just breaks the

02:10:05 X law of thermodynamics because how come they're eating the same number of calories and not getting wet and of course by that time we figured out that at least in Mouse Timeless repeating also changes the gut microbiome in a way that the mice may be popping out a little bit more fat than sugar than absorbing them so one thing that happens in time restricting at

least in mice is the liver cholesterol metabolism to bile acid and bile acids excretion in the gut changes because they gut microbiome changes so this is a

02:10:44 very nice study when Amir jarinpar was in the lab now he has his own lab in UCSD and he meticulously did that and we we even did bomb calorimetry from the poop and metabolomics from the poop and then we figured out that they excrete some some calories and then that brown fat activity goes up so there may be burning some of these extra calories so they're more thermogenic more thermogenic but anyway so you know one nice thing awesome thing about Salk is if they say that your science is going well then they will find ways to help

02:11:22 you and this is terrific yeah and um this is when Bill Brody was our president he was the president of um um Hopkins for 12 years and then he was president and um that time he had started this Innovation grant program which was funded by arvind Jacob uh Arun is the founder of Qualcomm it was also a faculty at UCSD so he understand there are very few Tech leaders who actually spent some time in Academia so he understood the pain of getting grant money when you have some interesting idea or test some

02:11:59 ideas so yeah no knock on the NIH but I'll do it anyway because I sit on study section for the NIH I mean NIH wants to see proposals for things that are so certain to work that they're mostly done and so really groundbreaking work can happen and does happen with NIH funding but more often than not is it is the generosity of philanthropists like Irwin Jacobs and other people that allow the really pioneering um the new stuff the cool stuff yeah the groundbreaking stuff the stuff that really no I'm not gonna say really

02:12:31 matters it all matters it's all important no it matters but uh you know it's high risk and um NIH when San is is not just government is not making money from thin air means it's taxpayers money so there is a little bit responsibility or conservative that okay so we should not waste tracks first money on buying this guy we're not talking about politically conservative we're talking about um scientifically conservative to be so careful what language nowadays pretty soon we're just gonna sit and stare at

02:12:59 one another at the microphones to stay safe um so so that's interesting so they so that's why I started this and then what we did was we um I had an awesome grad student and we got this funding from Arwin and also there are some any philanthropy matters so actually the way we say is yes if you give me 50 bucks then that 50 bucks towards goes towards buying the gloves and a friend of tubes for one postdoc for maybe seven days so it's so true I think a lot of people don't realize that 99 of laboratory scientists just they they

02:13:34 don't make any money off their discoveries and even if there is a patentable discovery typically the The Divide between the institution and the company that will eventually put that to Market is so slim in favor of the the others involved that you know scientists really do this as a work of passion labor labor of love so so we we came up with this app my security and clock at that time and we took some um you know lessons from Tech leaders um particularly from Amazon one click checkout um because we thought most nutrition

02:14:08 apps actually ask people to detailed describe or they add go to their food library and then person size they said okay so we'll just shortcut all of that I just ask people to take a picture of the food open the app one click take a picture second click and press save third click and when they said the picture actually came to our server did not stay on their phone and we asked 156 people who are not shipped workers just regular worker or Homemakers to be part of the study no student was allowed to be part of the

02:14:42 study because we know that there's a lifestyle is like ship workers and we monitor for three weeks and so here is some nuances and I want people to understand when somebody is starting to eat at say 7 A.M and since the recording everything we've we've got every single thing even if they ate half a cookie they had to take a picture and they actually took picture because it's not it becomes second nature after three or four days that every time they add something even if there is a glass of water they actually

02:15:17 take a picture because we asked them take picture of everything we'll figure out what it is what is surprising what we found the median uh so the median number of times people eat within a day 24 hours a day is actually seven so it's not it's not that we are eating three times a day we actually snack a little bit seven times per day seven times and there are 10 percent of people the top decile was eating 12 times a day wow um and it makes sense in retrospect sometimes maybe I'll fall into that seven or eight before

02:15:56 um I did this study because you know getting up having coffee with cream and sugar is one and then I ate my breakfast that's two then I came to the love and I found that cookie that's three I went to a meeting and there was some cookie and something else that's another one and lunch and then afternoon somebody asked me to go out and have a meeting and so if you think about it it's very normal that we can go seven to eight times ten times but then if we look at what time say I start breakfast and as I said and we see that

02:16:32 in many people they'll start at seven o'clock Monday then 7 30 another day then 8 15 another day or they go back to 6 a.m because they had to get up early and go to work so we took all this food data from three weeks and then asked what is the time when your body's system is expecting it to eat because it's kind of averages Southeast kind of thinking okay maybe for you if

you're eating breakfast at say somewhere between 6 AM 7 30 7 45 I eat it maybe you are expecting food around seven o'clock let's forget about

02:17:05 6 15 that's an outlier and then similarly at the end of the day if somebody is eating finishing the last bite or the night Gap whatever you call it say one day at 9 pm 9 30 p.m 10 11 12 30 or 1. Let's ignore that 1 and 12 30 but still we got somewhere between seven to eleven thirty for that person over three weeks time so this is how we kind of figure out what is the likelihood that your body will encounter food so when we do that what we found was nearly 50 percent of our dogs in our study ate for 14 hours 45 minutes that window

02:17:44 when your body is expecting food so it's easy to say that 50 of adults are eating within 15 hours or longer wow and and quite frequently throughout quite frequently too and then if we ask what fraction of our adults were actually eating the conventional within 12 hours three meals a day or something like that it was 10 percent so this snacking has gone up dramatically however you wanted to find snacking the frequency of food intake throughout the day and outside this breakfast lunch and dinner there are all

02:18:20 these small snacks here and there and also for a lot of people the dinner is delayed and we went back and looked at okay so what kind of food people are eating late at night and all that stuff and what came out interesting which is very counterintuitive is people who prepare their own dinner they're more likely to eat later at night because they're coming home and then they're taking some time to prepare dinner and then they're sitting down and eating or maybe they're eating next to the computer whatever it is

02:18:50 so it's kind of interesting that came out um but coming back to your point that's why I say that nearly 90 percent of adults are eating for more than 12 hours so that means a lot of people can there is scope or there is enough head space to reduce and eat within so as I said all of this are interrelated so when you think about children most sleep researchers agree that children and teenagers should sleep somewhere between 9 to 10 or 11 hours because young children even five to ten year old they should sleep nine to ten

02:19:30 hours they're just pumping out growth hormone and growing growing and then the teenagers actually the recommendation is and they should be sleeping nine hours because if you take teenagers take out all the stimulatory inputs to them and then remove homework assignment and everything and then let them kind of equilibriate to their homeostasis what are likely how many hours they're likely to sleep that turns out to be somewhere between eight and a half to nine and a half hours which also means that going back to

02:20:04 sleep nearly 90 percent of high school students in this country are chronically sleep deprived because most high school students don't get nine hours of sleep on a regular basis maybe in the weekend probably because of devices yeah on iPads and also as I said this new idea that midnight is your assignment submission time I'll come back to that again and again I'm hearing that again again so teachers take note it's an issue it's a very interesting idea as a way to kind of anchor Behavior earlier in the day yeah learning to in I

02:20:38 mean Public Health uh is complicated because people are incentivized by fear but they you know you get more bees with honey as they say right you know there's uh incentivizing people to wake earlier not necessarily with the sunrise but wake earlier and go to sleep earlier and eat within an 8 to 12 hour window um 12 if it's yeah so that's my children yeah it sounds to me like you know all these health benefits are what I think are going to incentivize people more than for instance this idea that well if

02:21:10 you don't do this you're going to get Dementia or something right but like every day people will feel more healthy and more productive and so that's why I said that even if children are supposed to sleep for nine hours of course they're not eating during those nine hours and we're not uh feeding children and putting them down to slay because you know their core body temperature will be high they cannot fall asleep so at least they should have their last meal one or two hours before going to bed because

02:21:35 typically parents feed them and maybe give them a shower or a butt and then they read the bedtime story so it's one to two hours before bedtime they're finishing food similarly on the other end after they wake up it's not that we're waking them up and then feeding them so hopefully we're not doing that so that's at 12 hours seems to be Optimum and it's not only I'm saying that if we put all the health recommendations together from pediatricians and then it makes sense um fascinating I have a question about

02:22:11 structuring meal intake or food intake um during the eating window um I have a good friend actually he's um he's the neurosurgeon at neurolink now but he came up through Stanford and um and he has a habit of eating of skipping one meal per day within a feeding window so it might be breakfast lunch skip dinner one day then it might be breakfast dinner the next day lunch and dinner the next one so it's not in keeping with the same start time always but the end time is either going to be earlier or there's a gate it's never

02:22:45 later yeah it's never later um what do you think about that as a strategy um you know in many ways it feels like that fits with the way that a lot of people's lives run so sometimes for instance if I'm in a podcast I don't tend to eat much in the middle of the day because it makes me a little bit groggy the post perennial dip in energy so I'll do breakfast well but again at 11 and that's a

first that's when I break my fast 11ish and then dinner maybe a snack in the middle of the day but other days it's three meals so does

02:23:15 it matter um overall as long as um one isn't allowing the start time and the ending time to drift out is it okay if you go from 12 hours to ten to eight eight ten four twelve as long as you don't exceed that the the brackets are you okay uh so this is where the Circadian aspect come in because if you're going um if you're moving that breakfast time or dinner time three four hours essentially causing maybe a metabolic jet lag you know in short term in weeks months or maybe even few years you may not see any

02:23:53 change um at the same time we don't know what is the long term consequences one thing is we always think I'll come back to this point again and again we think that a body weight is a marker of Health or body composition is a marker of Health it's not always true because as I said issue drift locks um filling um you know having some Pang of depression or anxiety or LDL like high LDL a lot of thin people have or low body fat people have very high LDL yeah so those are the things that um we don't connect with our habit and since

02:24:30 security under them and meal timing meal structure now is a very new um field um I think good studies will come out only in a few years because right now people are just going back and retrospectively looking at some Diet record one day of diet record and trying to glean too much out of it but I think hopefully things will improve where people will become it will become standard to at least look for one week of diet record meal time and what they're eating all that stuff because uh are now Mouse studies also showing what

02:25:04 a front loading carbohydrate or front loading fat or protein has benefit over so I think this studies are starting so I should not comment whether that's good or bad no I think it's great to hold off until then we have you back on to discuss um I have a question about um fasting on the longer term um and there it's a near Infinite Space we could explore of two days of fasting one day I know people that every once in a while they just decide I'm fasting they've either been eating too much at parties or they're not feeling well or

02:25:39 whatever they just decide I'm fasting for 24 hours and um they'll still consume water and caffeine but they'll just fast is there any health benefit or detriment um you mentioned the circadian clock shifting effects but if somebody wakes up on Sunday and they you know they ate too much or they feel they ate too much or they don't like the food they ate on Saturday they're not really feeling it and they're just going to fast into Monday is there any known benefit or um Health detriment to doing that kind

02:26:07 of thing yeah there's actually a rich literature on this complete fast um an impact in many religions people practiced complete fast as you were to cleanse their body and people have seen that there are benefits to that so in fact the every other day eating in Mouse model or even in humans are also initially some studies were done there are many health benefits and right now there are even fasting clinics in Germany where people check in and they're under strict supervision and then they do complete fast or maybe a

02:26:48 small bowl of soup which has 100 200 kilocal and that's all they get to eat sometimes two three days four days five days even they have gone up to three or four weeks for sake of weight loss is that why from many different things and um they come out pretty well healthy of course they're under supervision make sure that they're getting macro micronutrients sorry the micronutrients vitamins and electrolytes so those studies are pretty solid people have observed that and then in fact there are even idea that fasting this

02:27:25 kind of fasting can have huge impact on brain and people may come out of treatment resistant depression or something but you know so those studies are very difficult to do they're only case of one here and there that we hear once in a while but hopefully in future we'll see um whether the depression anxiety the mental health aspect will benefit from fasting because now as there is more and more evidence that there's this gut brain axis and whether the presence of food or the microbiome changes in the

02:27:59 gut if they can affect brain then maybe long-term fasting periodic fasting a few days of low calorie diet back to back will be interesting to see how it impacts brain health very interesting what are your thoughts on fat fasting where people try and limit their blood glucose by only eating mainly fats mainly healthy typically they'll eat healthier Fats of avocados olive oils and nuts you know and some animal fats perhaps but um as a way to keep blood glucose low and also time restrict this goes back to the

02:28:37 kind of low carbohydrate um thing what are your thoughts on that as as a general strategy for health I mean it combines sort of two general themes that are out there I think both of which are you know data are still incoming that restricting the feeding times it can be beneficial as well as keeping overall blood glucose lower can be beneficial yeah I think there is too much uh emphasis now on blood sugar spiking or um we don't know um this kind of eating pattern for example means we are essentially telling

02:29:09 pancreas that okay it's or the eyelid cells that produce uh insulin and it's okay you can take um take a break go on vacation for you for a month or two or three months um my question is it will be interesting to see what happens to those eyelets because for example we know that if we this user unused our muscles that is muscle atrophy muscles will become weaker we don't know

whether long-term consequences of this very low carbohydrate diet where you are not essentially engaging the eyelid cells periodically what is its

02:29:54 impact so if there is no impact maybe it's okay maybe because as you know many people who actually work on ketogenic diet the researchers themselves they find it very difficult to stay in true ketogenic diet because the true ketogenic diet is consuming less than 10 percent of calories from carbohydrate and not very many from protein a lot of people think ketogenic diet allows them to eat massive amounts of meat and that's not necessarily the case just one clarification for people um uh Sachin was referring to islet

02:30:25 cells of the pancreas which are the ones that manufacture insulin so the question is whether or not taking in low levels of blood glucose by way of a low carbohydrate diet those islet cells are going to shut off their production very interesting I mean the liver is a very plastic tissue I mean it tends to um react very dramatically to Lifestyle Changes yeah so that's why it was interesting to see what happens means we know that even muscle issues for example people who become bedridden the loss of muscle mass but when they

02:30:54 come back and exercise they gain it back so it'll be interesting to see what happens in these people who are going through long-term ketogenic diet and of course once in a while because of social pressure or something else if they don't have access to food or something happens they may consume some sugar some blood glucose will Spike but it's not that every spike is bad I mean the reason why we have insulin is for good reason to buffer that Spike to buffer that Spike and also you know people always say that well if you have

02:31:27 insulin produced or insulin like growth factor those are really bad and it should avoid that and I think that's a little bit extreme and I mean that's the insulin growth factors involved in muscle protein synthesis tissue repair yeah maybe even cognition so yeah yeah and it also goes back to as a m tour activation and all that stuff people get really excited about how to reduce them to activation rapamycin and all that stuff so this is where um again from circadian point of view um I ask people to think okay so

02:32:04 two very popular drug like molecules or drugs that people think will increase longevity or metformin which many people agree not all will come to a consensus that it activates MP kinase or the sensor and the cells that sense that your cells are fasting so metformin kind of activates it so that it kind of you can say although it may not be scientifically accurate uh the um you know fasting and appeal so it sort of mimics fasting yeah and the and the thing I'd lump in there with metformin is that berberine is kind of

02:32:41 the Poor Man's metformin it's a tree bark extract that also dramatically lowers blood glucose yeah yeah and it mimics kind of that um fasting and then rapamycin um also kind of reduces Emptor activation and people have shown that rapamycin and Metformin can extend Mouse lifespan and in improve health okay so now let's go back to the calorie restriction study that I mentioned in calorie restriction people are giving food as a lump sum and they were essentially doing time restriction the mice were doing time restriction

02:33:22 if we think about it during day time when experimenters are coming to the bivarium the mice should be sleeping and fasting and they should naturally have high level of MP kinase if they're truly fasting and they should also have low level of interactivity because M2 responds to insulin and that should go off at night so my suspicion is um in many of these experiments where the mice were allowed to eat at Louis Vuitton even normal standard Char now we are we know that as mice get older they actually consume little bit more food

02:34:06 during day time which is the equivalent of human night humans nighttime it is like nighttime eating we know is an issue I didn't realize that was more of an issue as people age but yeah so we don't know but at least in mice because you know we can put demise in calorimetry look at every single by dieting how much they're eating so I guess it was natural to see that researchers found that there is some mtor activity during day time when the mice were not supposed to have M3 activity because they should be fasting

02:34:35 and since they ate little bit they were snacking during day time amp kinase activity was not at its peak so giving metformin kind of mimic that fasting state and reducing M productivity by drug like rapamycin also kind of mimics some aspect of the fasting state so my suspicion is um since these studies were done always in mice who are supposed to be in the fasting State and both enter sorry rapamycin and mpkin is activated or metformin kind of are mimicking that fasting State that's why we have seen those benefits

02:35:18 and it will be interesting to see if that experiment will be done in humans in the long term because many people are very excited about you know there is M total long-term metformin study and then a lot of people are actually consuming good amount of rapamycin off level they can get their own so that's my curiosity I'm not saying whether it's good or bad or whether there is science or not that's something that will be interesting to control for and see because recently I saw one of my again close friend and colleague at Scripps

02:35:53 suited a very simple elegant study people should have done in metformin field so it took mice and then measured their blood glucose at different time of the day and in fact just like human blood Lookers our blood glucose fluctuates a little bit uh she saw that rhythm and then in every two hours or three hours um on different days of course so you have the same dose of

Metformin to mice and what she found was a different time of the day metformin had very dramatic change in glucose reducing ability

02:36:30 so which means that even if you take metformin and give a different time of the day for the mouse or even for humans in very long term of course in this mice this mice were not diabetic or anything they were healthy mice to begin with so in long term we might see um benefits that are very different so this brings to this idea that well maybe metformin say at the end of the day evening metformin May trigger that fasting State much earlier than end of digestion whereas metformin in the beginning of the day

02:37:07 may not at least from longevity perspective I'm not talking about Diabetes Type 2 diabetes here so the same thing with Emptor um is mtor going to have much better impact if taken during evening morning before meal so um these are my thoughts that go along with all this fat um story that we talked about do you take Metformin or Burberry I know I haven't taken although you know um I have close uh friend and colleague um Ruben Shaw who is now the director of Cancer Center at salki extensively works

02:37:45 on MP kinase and its mechanisms and um so it's always fun to talk to him he's a he's a fan yeah I've taken berberine before and I've had two different very distinct experiences with them first of all um berberine when ingested with carbohydrates in particular carbohydrates to have a lot of simple sugars definitely I know this because I measured my blood glucose I did the experiment allows you to flatten out your blood glucose response so you know in some sense if you're you know there is this idea if you're going

02:38:18 to eat a particularly big meal or sugary meal and you don't want to get a massive blood glucose rise you take berberine or metformin metformin is yeah prescription that's I went with berberine because it's as far as I know it works as well yeah um at least for healthy people yeah for healthy people that's right um when I took berberine and did not ingest large amounts of simple sugars or carbohydrates along with it I experienced profound hypoglycemia I felt like complete garbage for about eight

02:38:47 hours and I had one of the worst headaches of my life because which makes sense you just got a blood sugar crash so if you lower blood your blood sugar when you already have fairly low blood sugar and you're not ingesting carbohydrates you can really bottom out your blood glucose so just say it's I say that as a for two reasons one is kind of a cautionary note and the other one that um when you think about the biology of these compounds it makes perfect sense and I think that um and I did not pay attention to

02:39:11 circadian effects yeah yeah I mean you know when I joined Salk um is the kind of the um big liver and sick in metabolism and he works on nuclear hormone receptors um these are the master regulator of metabolism and normal cells cancer cells and many other and what was interesting was in the first few years Ron did a very simple experiment he just looked at what time of the day this nuclear hormone receptors are turned on at gene expression level and some are protein level and he found that almost all of

02:39:47 them have a circadian pattern at least in some tissue so he went to that length to say even that circadian is metabolism and metabolism is circadian the reason why we have a circadian rhythm is to have a daily rhythms in food seeking behavior and eating and also go through a period of time when we should be fasting and then on the other hand all the metabolic Regulators also have to follow that rule and almost all metabolic Regulators everything that we can think of connected to metabolizing macronutrient protein carb

02:40:33 and fat they should also have a circadian rhythm or diurnal cycle to align or misalign so for example fat oxidation should be in opposite phase with feeding and um you know in retrospect at that time it was kind of amazing to see Ron could foresee of course he's smart enough to foresee and predict that this is going to happen to circadian field because at that time we're thinking about the suprachiasmatic nucleus sleep quick cycle and we are not thinking too much about metabolism so that's the awesome thing about song being at Salt

02:41:08 because we have 50 pis really crammed into two awesome buildings and with Open Lab structure so you bump onto each other and talk to you so and with an ocean view oh it's awesome view yes it's an amazing place I was lucky enough to have an adjunct position there when I when my lab was at UCSD and uh it is an amazing Place doing incredible groundbreaking work which of course includes yours listen uh Sachin I I'm clear now that um we have to have you back on for another uh series of discussions seriously speaking if if

02:41:44 you'd be so so uh kind and willing to do that I want to thank you for several things first of all for your taking the time today to sit down and discuss these um incredibly interesting ideas in detail you know much of what we talk about on the podcast is uh obviously grounded in science and and often but not always as actionable and so much of what we talked about today is actionable in the sense that many people are already doing certain dimensions of these things some are not some are hearing about it and

02:42:14 considering it you've given us dozens I've listed some out dozens of tools and considerations based on whether or not people are engaging in shift work or not I think a lot of people are going to realize that they are shift workers yeah even though they didn't think they were um because of the nature of their habits now to light and activity and so forth um I absolutely love

the firefighter study because of its relevance to the general population also not another nod to
fighter fighters and shift workers everywhere thank you

02:42:42 and you know I think among the colleagues I've known for several decades now you
really are one of a very small few who've managed to do both animal studies and human studies but
also animal studies with a very clear eye and a pointer toward human health and um that's such a
vital and rare thing especially in this day of um extremely competitive funding so I want to thank you
for your time today for the knowledge you share the actionable aspects of that knowledge the
science that you're doing in your

02:43:15 laboratory we will provide links for people to learn more about you and of course to
go to the app yeah um so people can um engage in some of the science directly and of course you
have several wonderful books now that we will also link to both of which I've read and are wonderful
in particular the book um the first book but also a book related to diabetes and um so for diabetics
and people interested in metabolic and blood sugar regulation um there so yeah on behalf of myself
and my team here at The huberman Lab podcast

02:43:44 and all the listeners I just want to say thank you so much your time is valuable and
the fact that you'd share it with us and educate so many people is really a gift yeah thank you and
actually likewise there are very few scientists who have taken this leadership role that you have
taken to uh come and communicate science to the public it's not easy because sometimes you
have to distill it down to a simple sound bite to the point where the scientist and they'll say oh that
may not be right but we always have to

02:44:17 keep in mind that we are always living in the dark is of science because the reason
why I say that this is not my quote actually this is from one of my scientific hero Paul simel from
Scripps Yola says think about it 10 years ago what do you what you thought was right and the best
has already changed but one thing is the Circadian rhythm and aligning it to our internal clock to our
habit is very important and as you mentioned uh we have our my security and clock app which is
research facing but

02:44:54 we have also distilled all of this down to five or six timing component and we have a
new app called on time health or get on time Health to people access that through the standard
app stores yeah so now it's available in in app store uh sorry uh Apple App Store and we want to see
uh how because people always think about fasting but as we discussed today feeding fasting or
eating fasting and activity and sleep a kind of interlinked and we have to kind of balance both of
these so that's that was the idea behind

02:45:29 this on time health program and um thank you Andy because what you're doing is immensely necessary particularly these days when science is moving at a very fast phase there are a lot of results coming out sometimes something can be very confusing and you spending your time to communicate science is exceptional so thank you well you're most welcome it's um days like today where I get to sit down and talk to brilliant colleagues like you who are doing the important work that that really matters so much

02:46:05 and so as you um mentioned a moment ago that there's uh a lot of darkness and confusion out there but uh thank you for being uh one of those whose Shining Light thank you thank you for joining me for today's discussion with Dr Sachin Panda all about circadian biology and time restricted feeding if you're learning from and are enjoying this podcast please subscribe to our YouTube channel that's a terrific zero cost way to support us in addition please subscribe to the podcast on both apple and Spotify

02:46:35 and on both apple and Spotify you can also leave us up to a five-star review if you have questions for us or comments about the podcast or topics you'd like me to cover or guests that you'd like me to include on the huberman Lab podcast please put those in the comment section on YouTube I do read all the comments in addition please check out the sponsors mentioned at the beginning and throughout today's episode that's the best way to support this podcast on various episodes of The huberman Lab podcast we discuss supplements while

02:47:01 supplements aren't necessary for everybody many people derive tremendous benefit from them for things like improving sleep supporting hormones improving focus and so on the huberman Lab podcast is proud to have partnered with momentous supplements we've done that for several reasons first of all momentous supplements are of the very highest quality and are used with various sports teams and various studies through the Department of Defense and so on and momentous supplements tend to be in single ingredient formulations single

02:47:27 ingredient formulations are absolutely essential if you are going to develop the most cost effective and biologically effective supplement regimen for you because simply put they allow you to adjust the dosage of individual ingredients to alternate days that you take different ingredients to cycle them and so forth in addition momentous supplements are available internationally which many other supplements are not if you'd like to see the supplements discussed on the huberman Lab podcast you can go to live

02:47:52 momentous spelled ous live momentous.com huberman if you're not already following me on social media it's huberman lab on Instagram Twitter Facebook and LinkedIn and at all of those places I cover science and science-based tools some of which overlap with the contents of the huberman Lab podcast but much of which is distinct from the content covered on

the huberman Lab podcast again it's hubervin lab on all social media platforms if you haven't already subscribed to the huberman Lab podcast neural network newsletter it's a monthly

02:48:18 newsletter that includes free tool kits for things like toolkit for sleep how to enhance the quality and duration of your sleep toolkit for Focus toolkit for neuroplasticity toolkit for deliberate cold exposure heat exposure and summaries of podcast episodes all of those toolkits can be found by going to hubermanlab.com go to the menu scroll down to newsletter and simply give us your email we do not share your email with anybody and again the newsletters and toolkits are completely zero must end you will also find some PDF examples

02:48:45 of previous toolkits again that's hubermanlab.com thank you once again for joining me for today's discussion with Dr Sachin Panda I hope you found the conversation to be as informative and actionable as I did and last but certainly not least thank you for your interest in science [Music]

00:00:00 welcome to the huberman Lab podcast where we discuss science and science-based tools for everyday life I'm Andrew huberman and I'm a professor of neurobiology and Ophthalmology at Stanford school of medicine today we are discussing dopamine dopamine is a topic that I've covered before on this podcast and many people have heard of dopamine most people know that dopamine is involved in pleasure to some extent or another and nowadays people are starting to appreciate that dopamine is also intimately involved with motivation

00:00:33 drive and pursuit well today you're going to learn that indeed dopamine is responsible for all of those things but you are also going to learn that dopamine is critical for overcoming procrastination for ensuring ongoing motivation and indeed for ensuring confidence in fact we are going to talk about the relationship between dopamine and motivation and confidence at the level of neurobiological circuitry and we are going to cover tools that will allow you to leverage your dopamine in order to have a maximum

00:01:03 motivation to overcome sticking points which include things like procrastination but also by understanding the neural circuits in the brain and body that release and use dopamine but more importantly by understanding what are called dopamine dynamics that is what gives rise to Big peaks in dopamine or troughs in dopamine or what's referred to as our Baseline level of dopamine which turns out to be our Baseline levels of motivation and feelings of well-being by understanding how those things relate to one another I

00:01:33 assure you that by the end of today's episode you will be in a far better position to understand why you become a motivated why you procrastinate how to ensure motivation on an ongoing basis and even how to leverage effort and the desire to become motivated as a way to do just that to become more motivated today's discussion is not about psychology although I will center around practical everyday examples and offer many many tools that you can implement if you choose today's discussion is really about pulling apart these things

00:02:04 that we call motivation reward pleasure procrastination and understanding them in terms of their dopamine Dynamics so whether you've heard me or others talk about dopamine before or whether or not today is your first exposure to the topic of dopamine today's episode is really designed to give you the biological and practical knowledge so that you can leverage your dopamine circuitry and your dopamine levels as well as tools to adjust dopamine circuitry and levels in order to optimize mental health physical health

00:02:32 and performance before we begin I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford it is however part of my desire and effort to bring zero cost to Consumer information about science and science related tools to the general public in keeping with that theme I'd like to thank the sponsors of today's podcast our first sponsor is Helix

sleep Helix sleep makes mattresses and pillows that are the absolute highest quality I've talked many times before on this

00:02:57 and other podcasts about the critical role that sleep plays in allowing you to be awake and alert and have a good elevated mood throughout the day sleep is just fundamental to our mental health physical health and performance and there's no replacing great sleep a key thing we all need in order to get excellent sleep is to have an ideal sleep environment Helix mattresses are designed for your unique sleep needs in order to ensure that you get the best possible night's sleep so if you go to the Helix site and you take their very

00:03:24 brief two or three minute quiz it will ask you questions such as do you sleep on your side your back or your stomach do you tend to run hot or cold throughout the night and they will match you to a mattress that's specific to your sleep needs I match to the dusk mattress that's the one that works for me and since sleeping on the dusk mattress now for well over two years I've been sleeping better than I ever have before so if you go to their site you take the quiz and you figure out what's the ideal mattress for you just

00:03:48 go to helixsleep.com huberman take their two-minute sleep quiz and they'll match you to a customized mattress and you'll get up to 350 off any mattress order and two free pillows again if interested you can go to helixsleep.com huberman for up to 350 off and two free pillows today's episode is also brought To Us by whoop whoop is a fitness wearable device that tracks your daily activity and sleep but also goes beyond that by providing real-time feedback on how to adjust your physical training and sleep schedule and

00:04:17 other activities throughout your day in order to optimize your health I've been working with whoop on their scientific advisory Council to help Advance whoops technology and mission of unlocking Human Performance not just for athletes but for everybody as a whoop user I've experienced the health benefits of their technology firsthand for instance it tells me of course whether or not I had a good night's sleep or a poor night sleep by giving me a sleep score it tells me the percentage of rapid eye

00:04:40 movement sleep to slow wave sleep but whoop also tells me for instance whether or not certain activities during my day time such as naps or training or training of a certain amount of intensity how that's impacting my sleep and vice versa if you're interested in trying whoop you can go to join.woop.com huberman again that join.woop.com huberman today and you'll get your first month free today's episode is also brought To Us by Roka Roka makes eyeglasses and sunglasses that are uniquely tailored to the needs of

00:05:08 athletes and everyday people the company was founded by two All-American swimmers from Stanford and everything about Roca eyeglasses and sunglasses were designed with the biology the visual system in mind I've spent a lifetime working on the biology of the visual system and I can tell you that your visual system has to contend with enormous number of challenges in order for you to be able to see clearly Roca eyeglasses and sunglasses are designed such that when you go from one environment to the next

00:05:32 like a brightly lit environment to a less a brightly lit environment you don't notice that transition you always see with perfect clarity another terrific thing about Roka eyeglasses and sunglasses is that many of the performance glasses out there that are designed for sport make people look like cyborgs which if you want that they do have those options the cyborg options as I call them but they also have many options where the aesthetic is more of the sort that you would wear to dinner or to work or anywhere that you happen

00:05:57 to be if you'd like to try Roca eyeglasses or sunglasses go to Roka that's Roka Dot com and enter the code huberman to save 20 off your first order again that's Roca roka.com and enter the code huberman at checkout the huberman Lab podcast is now partnered with momentous supplements to find the supplements we discussed on the huberman Lab podcast you can go to live momentous spelled ous live momentous.com huberman and I should just mention that the library of those supplements is constantly expanding again that's

00:06:25 livmomentis.com huberman okay let's talk about dopamine what is dopamine dopamine is what's called a neuromodulator which simply refers to the fact that it's a chemical that modulates or changes the electrical activity of other cells and the cells I'm referring to are neurons neurons are just nerve cells so you have a brain and a spinal cord and the neurons in your brain and spinal cord connect to one another and they connect to different areas of the body including basically every organ of your body and

00:06:57 every organ of your body communicates back to your brain and spinal cord through Direct act or indirect Pathways for instance you have neurons in your gut that sense what sorts of nutrients you've eaten or drank and then send neural signals electrical signals up to the brain and indeed that whole process happens to be modulated by dopamine dopamine as a neuromodulator has the basic property of either ramping up increasing or decreasing the activity of other neurons and that's done by adjusting things like electrical

00:07:27 potentials and things of that sort that we really won't go into this episode but that I promise to get into in detail in a future episode if you're interested in the biochemistry and biophysics of neurons and things of that sort so we have this neuromodulator dopamine and we know that that neuromodulator can increase or decrease the activity of other neurons so then we

have to ask ourselves where is dopamine released in the brain and body and what specific types of neurons is it impacting in other words what

00:07:54 specific types of functions does dopamine have so there are basically five circuits within the brain that use dopamine as the primary neuromodulator and those five circuits engage different but related functions so I'm going to go through them one by one relatively quickly giving you a little bit of nomenclature and some sense of what each of those circuits looks like and what it does the first circuit is the so-called Nigro striatal pathway so in the back of the brain there's an area called substantia nigra named because the

00:08:25 neurons that are actually very dark they actually contain pigment you'd be able to see this if I were to slice up a brain you'd see two dark regions in the back that substantia nigra contains neurons that are chock a block full of dopamine but they release that dopamine in a brain structure called the striatum the striatum is involved in movement both the initiation of movements and the suppression of movements in so-called go action and no go suppress action pathways topic for a future podcast the

00:08:53 second brain circuit that uses and leverages dopamine to a great extent is the so-called mesolimbic pathway now you'll also in a moment hear about the mesocortical pathway so today I'm going to talk about these somewhat interchangeably at times but where it's important for me to differentiate between them I will do that both of these Pathways initiate from a set of neurons in the so-called ventral tegmental area or VTA I will use that acronym VTA the VTA functions in close partnership with a different brain

00:09:23 structure called the nucleus accumbens or n a i don't think I'll call it n a today I'll talk about VTA ventral tegmental area and I'll talk about nucleus accumbens for sake of today's discussion you can lump those together if you want neurons in those areas project a bunch of different places but in the mesolimbic pathway those neurons are projecting to areas of the brain like the hypothalamus which sits right above the roof of your mouth and is responsible for a lot of basic functions things like maintaining your body

00:09:50 temperature for libido in the pursuit of sex for Hunger for the generation of signals to the pituitary gland that cause the release of hormones and other things into the bloodstream so the connections which I sometimes refer to as projections from the neurons in the VTA and nucleus accumbens to the hypothalamus are basically using dopamine to modulate the output of a lot of different things that happen in this hypothalamus that controls a lot of we could call them primitive functions but they're really

00:10:22 basic functions for survival now the other pathway out of the VTA and nucleus accumbens is to the cortex that's why it's called mesocortical pathway so this is a very different pathway out of the VTA and nucleus accumbens than the one I just described a moment ago the pathway I'm talking about now the mesocortical pathway projects to the prefrontal cortex which is a structure that many of you have perhaps heard of but even if you haven't it's important to know this is an area that resides right behind

00:10:48 your forehead and that in humans compared to other species is greatly expanded in terms of its size and complexity of function so it's involved in everything from planning and executing of action to making good or bad decisions depending on context in fact one of the primary functions of prefrontal Cortex is to really understand context whether or not for instance you are alone in your room where certain behaviors are appropriate whether or not you are at work where other behaviors are appropriate

00:11:16 understanding what the context is and therefore what sorts of actions need to be generated and suppressed in fact a guest on the huberman Lab podcast and this is a guess whose episode hasn't aired yet described this beautifully he's a neurosurgeon and he said the way to think about the prefrontal cortex is it's basically an area of the brain that says or no not now to other brain regions in order to suppress action we know this because people that have damage to the prefrontal cortex often can't suppress their impulses okay

00:11:48 so the pathway from VTA and nucleus accumbens to the prefrontal cortex is absolutely critical for today's discussion because we are largely going to be discussing motivation Drive Pursuit procrastination and all sorts of things that have to do with our feelings about context whether or not we want to do something or not whether or not we feel we should or we shouldn't whether or not we feel we failed the last time or there's a high probability of success the next time prefrontal cortex does many many things but when thinking about

00:12:17 dopamine's role in the prefrontal cortex that is when thinking about this mesocortical pathway we really want to think about how dopamine is activating or changing our propensity to do certain things and get us into action or prevent us from doing certain things and prevent action so basically you can think about the mesocortical pathway as a circuit that really governs all of the major choices that you're going to make in life about what to do and what not to do toward your goals and away from the

00:12:44 things that you want to avoid now the fourth dopamine pathway in the brain is the so-called tubero infundibular pathway and this is not one we're going to focus on too much today this is a pathway that relates to connections between the brain and your pituitary gland your pituitary gland being that gland that's as I mentioned a moment ago is also receiving input from the

hypothalamus and is releasing a bunch of hormones into your bloodstream things like luteinizing hormone follicle stimulating hormone things like

00:13:11 melanocortin hormone these are hormones that are impacting everything from the function of the ovary and females to the function of the testes and males it's governing things like cortisol release under stress thyroid hormone meaning it's regulating thyroid hormone release and on and on dopamine has a very powerful impact on the output of the pituitary so again that's probably a topic for a future episode but it's important in reviewing the different brain circuits that use dopamine as a neuromodulator that I mentioned that one

00:13:42 then there's a fifth one and this fifth one is not often discussed and again won't be the main topic of today's discussion but for thoroughness and for clarity it's important that we mention it this is the circuit within your retina that is the pie crust-like lining of neural tissue on the back of your eye because remember your eye is actually part of your brain that got extruded from your brain during development you know those two eyes that you see in the mirror and that you see in other people

00:14:07 are actually two pieces of central nervous system and within the retina which is the neural portion of the eye within the neural retina dopamine is responsible for adapting to different light conditions so that you can see clearly both in the evening and when it gets darker you can still see a bit and in the morning when it's very bright you don't really have to make adjustments to your visual system in order to see clearly your visual system does it for you and one of the ways that it does that is through the

00:14:35 neuromodulator dopamine so today we are not going to discuss the retinal dopamine Pathways or the tuberinfrendibular dopamine Pathways and we won't really talk so much about the Nigro striatal pathway I'll say one more thing about it and then I'll leave it alone we are going to talk about the mesocortical pathway and we might touch on the mesolimic pathway a little bit as well so today we're mostly going to talk about mesocortical circuitry and function and dopamine within the mesocortical circuit and the reason that

00:15:02 we're doing that is that today's discussion is really about motivation procrastination goal setting and pursuit it's very important to understand that neither dopamine nor the mesocortical circuit cares about any specific goal or Pursuit this is a circuit that uses dopamine in order to pursue anything now of course some people have a greater propensity to pursue things like work or goals and Athletics or relationships or a combination of those other people unfortunately have a greater propensity

00:15:35 to pursue things like drugs of abuse what are drugs of abuse drugs of abuse tend to be drugs that increase levels of dopamine to the extent that other types of Pursuits in life that are adaptive for us like work relationship School Etc become Irrelevant in fact the definition of addiction that I use and that I believe really matches the neurobiology very well is that addiction is a progressive narrowing of the things that bring us pleasure healthy functioning of the mesocortical pathway however allows

00:16:05 us to toggle or switch back and forth between different types of Pursuits of all the sorts that I've mentioned earlier so if we can understand how that means the cortical pathway works just a little bit in particular when dopamine is released and when it's not released what dopamine does when it's released to our sense of motivation and drive and if we can understand a little bit about how our recent dopamine history that is whether or not there is dopamine in our system already dictates whether or not we are going to

00:16:36 feel motivated in the next 5 10 15 minutes hours days and weeks that is all very easy to understand I promise I'll explain it to you in a simple way but I want you to get a circuit into your mind I want you to Envision that there are these neurons little nerve cells in the VTA and nucleus accumbens those neurons make dopamine they send their projections that we call axons which are like little wires and they can release dopamine into the prefrontal cortex and now you already know because you learned

00:17:03 it a few minutes ago that the prefrontal cortex then can ensure that certain behaviors take place and other behaviors do not take place that or quieting that we talked about earlier with that in mind let's now take a look at how dopamine is released and let's keep two things in mind there are peaks in dopamine that is dopamine is released into the frontal cortex where it has these effects of activating or suppressing action and we can think of those as peaks in dopamine so if I call it a spike that

00:17:35 means an increase and then a decrease if I call it a peak it's an increase and then a decrease there can also be troughs in dopamine what do I mean by that well we have Peaks and dopamine and that Peak and dopamine can rise up and then go back to what we call baseline or there can be a trough it can go below Baseline so the two key things to understand about dopamine is that we have dopamine Peaks that are triggered by certain behaviors certain compounds drugs or substances food Etc and that we have a dopamine Baseline

00:18:11 our dopamine Baseline is our reservoir of dopamine it's how full or empty our dopamine pool is and that dopamine pool is the pool of dopamine that we use in order to create those dopamine Peaks and when those Peaks come down sometimes they go back to Baseline and sometimes they go to lower the base slime which we call the trough if any of this seems confusing I

want you just to imagine a wave pool this is an analogy that was given to me by one of our podcast guests which is Dr Kyle Gillette who's an obesity specialist and

00:18:43 works on a number of things related to endocrine hormone function including testosterone estrogen in both men and women you want to check out his episodes on Hormone Health now they're fascinating and actionable he's a tremendous wealth of knowledge and he has this analogy for how dopamine Works in our brain and body and that analogy is this notion of a wave pool if you've ever seen a wave pool it's basically a concrete pool and there are waves within it okay duh those waves can be of different heights so they can be

00:19:13 little Ripples and we can think of those as little mini Peaks or they can be big waves they can be really big crashing waves if the height of those waves and the frequency of those waves is very very large so some of that water which here I'm using as an analogy to dopamine can slosh out of the wave pool and the Baseline drops However if those Peaks are small enough or they are seldom enough well then the Baseline that is the water level in that pool stays more or less constant I think this is an excellent

00:19:49 analogy for how dopamine works in the mesocortical pathway as it relates to motivation and pursuit and all those sorts of things because we really need to think about how the Peaks and the Baseline relate to one another and this is very important the Peaks on the Baseline are not independent of one another they relate to one another so now you have in your mind a wave pool and just understand that if you get a great big huge wave maybe one of them it will crash out and some of that water will Splash out the Baseline will go

00:20:17 down a little bit but if you get big peak after big peak after big peak pretty soon you're going to empty that pool whereas if you have smaller waves or less frequent big waves well then the Baseline will stay relatively constant so let's think about dopamine Peaks and bass lines and let's remember that for every Peak there's a trough what do I mean by that well when you have a wave you also have the bottom of the wave when you have a mountain you have the bottom of the mountain when we think about dopamine Peaks and

00:20:48 dopamine baselines we have to include that trough because that trough that is the level of dopamine below Baseline really dictates whether or not you are going to feel motivated to pursue something or not so I'm going to give you a visual in your mind the visual in your mind is an increase in dopamine that's triggered by your desire for something and really could be your desire for anything if you're hungry and you're thinking about I really want a sandwich I really want to let's think what sandwich would I want right now a

00:21:20 really nice roast beef sandwich on sourdough with a slice of Swiss Tomatoes slice of pickle here I'm describing the sandwich that I would want so if you're hungry and you're thinking about that dopamine starts Rising this is crucially important to understand dopamine is not just released when we get the reward when we get the thing that we're pursuing dopamine is released in anticipation of what we want that increase in dopamine is by no happenstance no mistake relates also to our propensity and

00:21:54 desire to move remember earlier I told you there's a separate Circuit of dopamine that triggers movement and that when it's depleted is causing things like deficits and movement related to Parkinson's or other movement disorders well that's not pure coincidence that's because desire and the need to move in order to pursue and reach goals are one in the same process so if I desire a sandwich or I desire a cup of coffee or I desire some water when I'm thirsty there's an increase in dopamine that we could call a little

00:22:25 mini Peak and dopamine but then here's the key thing very soon after I realized my desire for something that Peak that was caused by the desire comes down and drops below Baseline below the level of dopamine that it was prior to even thinking about the sandwich or the coffee or the glass of water and it's that drop below Baseline that triggers my desire to go out and find that sandwich that coffee that water or that blank insert whatever it is that you happen to desire action or substance of any kind or person Etc

00:23:03 so that drop below Baseline is fundamental to the whole process and that drop below Baseline was triggered by the preceding Peak so let's say that I desire a sandwich there's an increase in dopamine then very quickly it comes down below Baseline just a little bit now I'm in pursuit of the sandwich I'm looking for where I can get that sandwich I can order it perhaps to be delivered I can go out and find it now is the stage in which I have to think about what are the different stimuli that is the things in my

00:23:32 environment that signal whether or not I'm likely to get that sandwich or not okay so for instance if I were to go to my phone and order food on an app or walk down the street and see the sign for a deli that's a cue that I'm likely to believe that drop in dopamine and get not just back to Baseline but then I'll get a peak in dopamine and indeed that's what happens if I find that Deli I go into the deli they're open they're making the sandwich that I want they make my sandwich and great I get that

00:24:02 sandwich and that sandwich will have some degree of inherent reward to it some degree of my liking it or not liking it so let's say I like it it's not the best sandwich I've ever had but all I'm doing is comparing my desire for that sandwich to the sandwich that I actually got and ate and chances are it's going to relieve that craving meaning it will take that dopamine that had fallen

below Baseline up up back to Baseline and if I like the sandwich it's going to indeed increase that dopamine again to another Peak

00:24:34 now if I love the sandwich like it's the most delicious thing that I've ever tasted in my entire life well then I'll get a big peak in dopamine when I consume that reward however chances are that sandwiches more or less as I expect it to be which is pretty good I'll eat it and I'm fine what do I mean by fine well there's a concept called reward prediction error reward prediction error says that the dopamine that it is experienced that is that's released from the VTA and nucleus accumbens is going to be of a certain value and

00:25:06 that value is going to be compared to the desire and expectation of what I thought I was going to get so if you take what you actually got minus what you expected that's reward prediction error so if the sandwich is basically what I expected to get fine dopamine comes down basically to a baseline level that's pretty standard for me and is basically the Baseline level I had before I ever thought about the sandwich at all if the sandwich completely surprises me and is completely amazing just an amazing sandwich well then the level of

00:25:35 dopamine that I experience when I consume that sandwich is going to be even greater and it's going to be that minus what I expected so there it's a bigger reward prediction error in the direction of higher Peak by consuming the sandwich and then of course there's the other possibility which is the deli's closed or the sandwich they make me is lousy or doesn't taste good or something happened in the consuming of that sandwich that just makes a bad experience in which case if we take that reward experienced

00:26:06 minus reward predicted from the initial craving well then it's going to be less than what I expected and therefore the Baseline drops below where it was prior to even Desiring the sandwich okay so all of this might seem a little bit complicated but it's all very simple desire for things increases dopamine but then our level of dopamine drops below Baseline and it's that drop below Baseline that triggers the motivation to bring that dopamine level back up by going and pursuing the thing that you

00:26:38 wanted in the first place now of course as this is happening you're not conscious of your dopamine levels you experience this as context-dependent craving and pursuit because remember the prefrontal cortex is involved in context setting and craving and pursuit because it relates to action and movement which is one of the general features of the dopamine system so you can start to see how this is a beautifully designed system and you can also see how it's a perfect system for desire and pursuit of

00:27:08 anything not just sandwiches as I'm giving you in this somewhat trivial but every day and therefore applicable example so just by understanding reward prediction error and especially by understanding that a craving triggers a peak in dopamine that makes you motivated but then drops your level of dopamine below Baseline which makes you even more motivated you are already halfway through the conceptual aspect of today's podcast because if you can understand that you will understand why for instance when

00:27:38 you initially want something or you think you want something it puts you into motion but then pretty quickly you're starting to feel the pain of not having that and that is also contributing to your desire to pursue that thing this is a subtle effect but if you watch for it you'll start to see it or experience it within yourself your craving for things is not just about craving for those things per se it's also a desire to relieve the pain of not having those things and if you can internalize that and start to develop an

00:28:11 awareness around it you will be in an amazing position to leverage all sorts of aspects of the dopamine system in order to increase your motivation especially when things get really hard or when you have the propensity to procrastinate which is something that we'll get into a little bit later in the podcast I'd like to take a quick break and acknowledge one of our sponsors athletic greens athletic greens now called ag1 is a vitamin mineral probiotic drink that covers all of your foundational nutritional needs I've been

00:28:39 taking athletic green since 2012. so I'm delighted that they're sponsoring the podcast the reason I started taking athletic greens and the reason I still take athletic greens once are usually twice a day is that it gets to be the probiotics that I need for gut health our gut is very important it's populated by gut microbiota that communicate with the brain the immune system and basically all the biological systems of our body to strongly impact our immediate and long-term health and those probiotics and athletic greens

00:29:06 are optimal and vital for microbiotic health in addition athletic greens contains a number of adaptogens vitamins and minerals that make sure that all of my foundational nutritional needs are met and it tastes great if you'd like to try athletic greens you can go to athleticgreens.com huberman and they'll give you five free travel packs that make it really easy to mix up athletic greens while you're on the road in the car on the plane Etc and they'll give you a year's supply of vitamin d3k2 again that's athleticgreens.com huberman

00:29:36 to get the five free travel packs and the year supply of vitamin D3 K2 now I'd like to talk about the Dynamics of dopamine release with a little bit more detail and this is something I've never covered on any social media post or on any podcast either this one or as a guest on other podcasts because on the face of it it might seem a little too detailed like why is he telling me all this

isn't it just enough to know that there are Peaks and troughs and bass lines and dopamine well it turns out that if you can understand what that

00:30:06 Peak and trough are really about in other words what's really happening when we zoom in on that Peak and trough you'll be in an amazing position to overcome procrastination and essentially pursue any goals in an ongoing basis so I'm very excited to share this information with you because I do think that it has tremendous actionable power what I'm about to describe relates to a number of different findings that have been made mostly over the last five to ten years although to be quite direct mostly within the last five years and it

00:30:36 has to do with the fact that the peak and trough and Baseline that I talked about a moment ago that are associated with craving they look like a peak followed by a trough followed by a return to Baseline and maybe another Peak if you get the reward or a drop below Baseline if you don't or you don't like what you got but if we were to zoom in on that Peak and the reward in other words really zoom in on the whole process and start thinking about the circuitry that is the neurons in VTA and nucleus accumbens and

00:31:04 how it relates to the frontal cortex in a bit more detail what we discover is nothing short of amazing what we discover is that whenever we're pursuing something we are always looking for cues as to whether or not we are on the right path to achieve that thing and we are also setting a mindset or a context within our brains as to whether or not we are confident or pessimistic as to whether or not we're going to achieve that thing now this is vitally important for anyone out there who finds it hard to get motivated and

00:31:35 stay motivated it's also vitally important for anyone who's psychologically minded in any way you don't have to be a psychologist but psychologically minded in any way and wonders why is it that some people are just so motivated and other people have such trouble with motivation why is it that some people require perfect conditions in order to achieve things and other people just seem to manage to pursue things no matter what it also relates to the fact that some of us are very good at achieving our goals in one

00:32:04 context and not so much in another so here's what you need to understand I'll stay with the example of the roast beef sandwich just because we already have that in mind but you can replace roast beef sandwich with essentially any goal the cue that we're going to likely get what we want so for instance the sign that there's a deli on the corner or that I open my phone and that there's an app that represents a restaurant that sells the particular sandwich that I like that cue as I mentioned before increases

00:32:36 dopamine you see that like oh okay and subconsciously there's already a signal that's initiated by that dopamine that I'm on the right path then as I mentioned dopamine drops below Baseline that's further contributing to my desire to go pursue that sandwich either with my thumbs on my phone through the app or with my feet and walking to the deli standing in line and so forth then as I mentioned before there is a peak in dopamine of varying height depending on how satisfying I find the reward to be

00:33:11 when I actually get that sandwich get that goal now keep in mind there is some time delay between the queue the app the deli Etc and when I get my sandwich that Gap is going to be different for different things so in pursuing uh you know four-year degree it's going to be four years if the diploma is your goal if if it's an exam you're studying for it might be a week long and there will be many other signals in between that initial cue that hey the the reward likely lies down this path in this textbook in um on you know this

00:33:47 dating app or at that Deli there are many other cues those cues come in subconsciously and involve everything from how long the line is at the deli to you know whether or not you're you know seeing the types of people on a dating app that you'd like to see whether or not they're responding to you whether or not someone's texting you back or not all of those cues are integrated and adjusting your Baseline level of dopamine all the time as you go to pursue that goal so what the dopamine system does is it

00:34:17 doesn't just compare the height of the Peak at the beginning right the I desire that to the reward that you got we talked about reward prediction error that's the that's the kind of first grade version of reward prediction error it's also taking into account all the things that happen in between and all of that is serving as a cue for the eventual reward and all of that is funneling into what we call reward prediction error in other words the dopamine system is very good at subconsciously parsing what

00:34:47 are the things that happen between wanting and getting and that's part of the learning that dopamine achieves and indeed there are specialized circuits from the VTA and nucleus accumbens that are involved in just the learning of how we achieve or don't achieve specific types of rewards that we desire so this is called reward contingent learning because it's learning the contingencies of what led up to a reward or what didn't lead up to a reward at the same time end in parallel there's an ongoing release of dopamine in the

00:35:20 background and that ongoing release of dopamine that has nothing to do with learning is really just sort of a propeller that's driving us in the direction of whatever it is that we're trying to pursue so I realize for some of you this might seem like unnecessary or perhaps even an overwhelming amount of detail but it's actually quite simple your brain is trying to figure out what

happened prior to getting or not getting a reward and it's comparing what you wanted compared to what you got at the same time the dopamine system

00:35:51 initiates a motivation signal that takes you through that entire round of pursuit and those three things there's the stimulus the desire the I want that that's the first thing that leads to that Peak the peak drops a little bit below Baseline and it triggers motivation the motivation is the second thing the motivation is dopamine release also but from a separate set of neurons within this circuit driving you forward and the entire time that it's driving you forward it's paying attention to what's there

00:36:23 along the way even if you don't realize it consciously and then there's the reward itself or the lack of reward itself so those three components the learning contingency which has to do with the stimulus and the reward and everything that happens in between and the propeller nature of dopamine as I'm referring to it those all combine into a total learning so that after you get the sandwich or after you finish the exam or after you go out on a date or after you do anything that you desire to do that system that originates in the VTA

00:36:56 and nucleus accumbens and goes up to your cortex it learned it learned many things it learned the contingency between stimulus and desire motivation and whether or not you succeeded or not it's basically a scoreboard for how you did given what just happened so actually it's all very simple in fact if you can understand even just half of what I just said you are now in a far better position to understand everything from addiction to motivation to procrastination and it will make sense of all the tools that

00:37:29 I'm going to talk about next which will allow you to overcome procrastination points to overcome deficits in motivation and indeed to reset your motivation in an ongoing way so that you can reach your goals okay so let's take everything that I just told you and set it aside it's still important but let's just say this you don't have to think about any of those details or names or anything let's just think about addiction because in biology and in Psychology frankly it really often pays to think

00:37:58 about the extremes first and then work our way towards more typical circumstances and with that said addiction unfortunately is very common nowadays I just heard a statistic in fact that there is an 8080 percent increase in alcohol use disorder among women in the last 30 years I talked a little bit about this in the episode that I did about alcohol and health again I want to be very clear I'm not somebody that is completely against alcohol for adults provided they're not alcoholics turns out two drinks a week probably

00:38:28 fine health-wise zero would be better if we're honest zero is better than any alcohol but two drinks a week is probably fine past two drinks you start running into problems and yet many many people out there male and female alike suffer from alcohol use disorder also called alcoholism the same is also true for things like methamphetamine or cocaine or other types of substance addictions and the same is also true for a lot of Behavioral or what are sometimes called process addictions things like sex

00:39:01 addiction or video game addiction or any type of behavior that frankly is leveraging the dopamine system but that engages this Progressive narrowing of the things that bring someone pleasure such that nothing else is really Salient nothing else is really pulling them in in the way that they're video games or sex or pornography or alcohol pick your substance or you know behavior that you see out there or hopefully not but that you might suffer from an addiction too so what's happening in addiction

00:39:35 well addiction involves dopamine among other things often the opioid system Etc but if we were to think about what's the stimulus in an addiction and what's the peak in dopamine and then what happens after that Peak It all becomes very clear as to why addiction happens and why it's so pernicious so for instance let's take cocaine cocaine causes dramatic increases in dopamine very very fast so if somebody craves cocaine what are they craving they're craving that dopamine Peak they're craving the

00:40:12 increased level of alertness they're craving a number of things associated with the feeling of being under the influence of the drug but the stimulus for it simply becomes that line of cocaine or in the case of crack that crack rock that they're going to smoke and God forbid they're mainlining it you know they're shooting into a vein what happens is they snort smoke or inject cocaine and dopamine levels almost immediately go up up up up up up to a very high peak okay so the the time gap between the

00:40:45 stimulus and the dopamine is very very short so short in fact that there's really no other contingencies in between that the mesocortical system has to learn in fact what is the system quote unquote learn it learns cocaine equals massive amounts of dopamine equals feeling euphoric and energetic Etc and in doing that it reinforces the whole circuit so that that short we can even say hyper short contingency is really what the system wants so much so that longer contingencies of say putting in the hard work of you know

00:41:27 generating a fitness program or a professional program for yourself or a education program which takes not just many days but many weeks and years well none of that is going to lead to peace in dopamine that are as high as the Pekin dopamine associated with cocaine so that tells us something critical it is both the duration between desire end effect and when I say effect I

mean the rewarding properties of dopamine that are experienced that's important so very short gaps teach the system to expect and want

00:42:00 short gaps makes it very hard to pursue things that take longer so when we say it's the short or in this case hyper short distance or time between the stimulus and the dopamine what we're really talking about if we were to plot this out on a board or on a piece of paper is the steepness of the rise of that Peak it's very very steep the peak in dopamine is coming up very fast after the desire and in addition to that and this is very important the higher the peak in dopamine and the faster the rise to that

00:42:35 Peak the further below Baseline the dopamine drops after the drug wears off okay so in the case of cocaine it's a very fast and very large rise in dopamine followed by a steep drop and very deep trough in dopamine below Baseline you say okay so there's pleasure then there's lack of pleasure ah but it's worse than that because it's not just lack of pleasure if you recall what we talked about a little bit earlier that drop below Baseline triggers the desire and the pursuit for what for more and so this sets in motion a vicious

00:43:15 Loop where people start pursuing peaks in dopamine that can come very fast without much effort and that's one of the ways in which addictions start to take hold there's a simple way to think about this and to remember if you want to avoid this whole thing I mean the first one is obvious don't do cocaine don't try it don't use it certainly don't get addicted to it those are all sort of one in the same frankly I don't know many people that despite opinions to the contrary that use cocaine recreationally that don't at

00:43:45 some point run into either a financial psychological physical or some other problem the other thing that's absolutely critical to keep in mind and this was discussed in my colleague Dr Anna lemke's book dopamine nation and on this podcast excellent book by the way I highly recommend it if you haven't read it already it's a fascinating exploration into dopamine as it relates to addiction not just drug addiction but other types of addiction again the name of that book is dopamine Nation we'll provide a link to it in the show note

00:44:12 captions the other thing that happens after those big fast increases in dopamine caused by things like cocaine is afterwards when it quickly drops below Baseline it takes a much longer time to get back to the original Baseline than it did prior to using the drug and worse still is that the peaks in dopamine that are created from more consumption of cocaine leads to progressively lower Peaks and deeper troughs below Baseline so the whole system is Shifting away from pleasure and more to pain and the desire

00:44:53 for pursuit of the drug now this is a terrible situation and it's a terrible situation that's not just unique to cocaine in fact if we were to look at the averages and again these are averages of the height of the peaks in dopamine that are created by different substances and the rates at which those Peaks take place because remember the time to Peak is just as important as how high that Peak goes we see some pretty interesting numbers so for instance and again these are averages based on neuroimaging combined

00:45:24 with um what are called pet scans positron emission tomography combined with blood draws and a number of other data from both animal and human studies you find is that at Baseline just kind of on a background of no drug taking of any kind the neurons in the Venture pigmental nucleus accumbens area are firing at a rate of about three to four per second releasing dopamine so that's your Baseline of dopamine release your your forebrain is always seeing a little bit of dopamine from from that system

00:45:54 if you were then to anticipate food and you're relatively hungry that would double okay so this probably happened when you decide to eat lunch today if you were hungry prior to eating lunch it doubles in the anticipation of the food and then depending on how much you enjoyed that food it might triple or quadruple it might be lower than it was during the anticipation as we talked about before so there's an approximate doubling under conditions of Desiring and consuming food let's take nicotine as the next example

00:46:28 for people that use nicotine either smoking vaping snuffing or dipping all routes of nicotine Administration that I covered in our episode about nicotine there's about a 150 percent increase in the rate of dopamine neuron firing cocaine is going to increase the rate of dopamine output into the prefrontal cortex by about a thousand percent okay so what you're really talking about here is a tenfold increase in the amount of dopamine that's released into the prefrontal cortex as measured by the rates of firing of these

00:47:04 dopamine neurons methamphetamine is going to be anywhere from a thousand percent anywhere up to ten thousand percent it really varies depending on the potency of the drug and a few other factors and here's where perhaps it gets a little more interesting some of you are probably wondering about caffeine or about sex or about video games now they're the numbers vary tremendously and it's really important to understand that across the board not just for caffeine sex video games but also for nicotine

00:47:34 alcohol and other substances and what we call motivated behaviors some of which are part of a healthy life like eating and reproduction you know provided it's you know age-appropriate context appropriate you know species appropriate consensual well then we consider it adaptive if it's not well then considered maladaptive some people will sit down to play a video game

they really like video games and as they're sitting down they will experience a five-fold increase in the rate of dopamine output from their

00:48:08 nucleus accumbens for other people it's going to be a tenfold increase for other people like me who don't like video games very much I don't have anything against them I don't dislike them but it doesn't do much for me it might not cause any increase whatsoever it might even cause a decrease in dopamine so there's a lot of individual variability for sex it turns out to be a range so the typical range that's cited in the literature is anywhere from a four to five-fold increase in the rate of dopamine neuron

00:48:33 firing however there are certain individuals for which that number is doubled caffeine is a little bit of a special circumstance because caffeine has the property of not just causing the release of dopamine but increasing the amount of dopamine receptors over time and there aren't a lot of excellent measurements of the amount of dopamine released as a function of caffeine intake in different populations of humans it's mostly animal studies but what we think based on the Gestalt based on the overall picture of the literature

00:49:02 is that it's an approximate doubling of the dopamine signaling that's coming out of the VTA nucleus accumbens to prefrontal Cortex when we anticipate and when we drink our coffee again I really want to be clear that for all of these things these are relative levels and they are distribution so if we were to plot them out on paper you would see that these are not bar graphs these are overlapping curves to some extent so some people are going to achieve more dopamine release or less dopamine release from one Behavior or

00:49:33 substance however it's very clear that cocaine methamphetamine even heroin for that matter are way out on the right hand side of the curve causing enormous increases in dopamine very quickly and the other things that we described have again a distribution that is more leftward shifted on this imaginary plot that I'm creating it's a lot of individual variability however it's fascinating that dopamine is the single molecule that's causing the craving and pursuit and experience of all of these substances and behaviors

00:50:08 and the learning of all of that craving Pursuit and actual experience is what predicts whether or not we will re-engage reuse that substance or not re-engage in a behavior or not and how frequently we will do that so that's addiction but if you understand how the height of those peaks in dopamine and the rate to reach those Peaks and the troughs that result and how long the troughs take to get back to Baseline if you understand or a little or all of that you're really in a terrific position to understand how to Leverage The dopamine

00:50:40 system for the pursuit of healthy goals and behaviors I should mention one thing about recovery from addiction which is that the reset of all that dopamine circuitry from unhealthy to healthy often involves depending on the addiction 30 days of complete abstinence that 30 days of complete abstinence inevitably involves a lot of pain and discomfort and craving anxiety insomnia Etc that relates to the big trough in dopamine that inevitably occurs now of course there are some addictions such as severe alcohol addiction and in some

00:51:11 cases opiate addiction that immediate and sustained abstinence cannot be used as the tool somebody really needs to work with an addiction specialist and sometimes there needs to be a tapering off of the substance for other addictions it can be quote unquote cold turkey and then of course there are other addictions particularly food and sex but sometimes even things like video games for which the desired outcome is not necessarily to eliminate the behavior completely but to set some constraints around the behavior so that

00:51:41 it's not occurring to the exclusion of other pleasurable things in life and adaptive things in life and for that there is the requirement for what are called binding behaviors we'll get back to binding behaviors later but binding behaviors or behaviors in which people bind their behavior around a particular substance use or around a particular behavioral addiction like sex Video Games Etc in space and or time in space meaning they might only engage in those particular behaviors in certain places and certain times when

00:52:15 it's context appropriate there are numerous examples of binding behaviors in space and time it all has to do with clamping or directing when the engagement with the dopamine releasing behavior is going to occur so what's happening when people decide to go cold turkey or they use these binding behaviors well what's happening is that people are engaging the specific circuitry within the prefrontal cortex that as I mentioned at the beginning of the episode are important for context setting so in the cases of binding

00:52:45 behaviors the prefrontal cortex is essentially getting trained up to understand that okay certain things like food or perhaps sex or perhaps video games they're okay if they are done or consumed in appropriate amounts or in particular context that requires the context setting goal directed behavior that the prefrontal cortex is responsible okay so for the last 10 or 15 minutes we've been talking a lot about addiction and actually this is not an episode about addiction however if you understand a

00:53:17 little bit about the dopamine Dynamics in an addiction you can leverage that knowledge towards healthy adaptive goal Pursuit and achieving your goals so let's think about that in the context of what generates dopamine Peaks what generates desire to pursue goals what causes our readout of whether or not we achieved a goal or not in other words what allows us to

learn how to pursue goals of different kinds not just get good at achieving one kind of goal but really understand and get really really

00:53:48 good at setting goals and pursuing goals of different kinds that are adaptive in different areas of life because we all are going to have to pursue goals in school work relationships Fitness mental health and on and on in order to be our best selves that's clear well all of that is possible using the same basic set of dopamine circuits and the same basic dynamics of dopamine so for instance if we are going to feel motivated at all that is if we are going to wake up in the morning or have any period of time during our day in which

00:54:22 we feel like we are capable of pursuing goals we are going to have to have a healthy level of Baseline dopamine in other words we are going to have to have enough dopamine in the wave pool enough water in the wave pool that is before we can generate any waves or peaks in dopamine let alone troughs and the rest so how do we achieve a healthy Baseline level of dopamine well there we can really look to some foundational practices practices that perhaps you've heard about on this podcast before and

00:54:52 that to some of you might seem a little mundane although some of them are a bit more sophisticated maybe even esoteric the good news is that we can all control these things and they don't require purchasing anything but they do require some degree of regular upkeep and effort those things include what I call the very Basics now the very Basics put in the context of today's discussion are the things that put water in the wave pool those are going to be getting sufficient amounts of quality sleep each

00:55:22 night something that we've done several episodes on and then have online toolkits for us you can see the master your sleep episode the perfect your sleep episode the light and health episode if you want to skip all that and just get right to the tools we have a sleep tool kit or it's actually called the toolkit for sleep that you can access at hubermanlab.com completely zero cost you just go there and download that toolkit getting sufficient sleep each night literally restores your dopamine reserves it allows dopamine to

00:55:49 be present and for you to have a level of Baseline dopamine that will allow you to even consider your goals in any kind of meaningful or reasonable way second there are practices that are supported by the scientific literature to increase your Baseline level of dopamine that are independent of sleep but are similar to sleep and I like to refer to these as non-sleep deep rest this is not meditation there's actually very little evidence that meditation of the traditional kind of you know sitting eyes closed third eye sent focusing on

00:56:19 your third eye center which is this area behind your forehead there is very little evidence that that increases levels of dopamine there is a place for meditation in the context of today's discussion but I'll repeat meditation itself is a focusing exercise it is not known to increase dopamine however non-sleep deep breaths so-called nsdr very similar although different to what's sometimes called Yoga Nidra which is where you lie there you do a sort of body scan some long exhale breathing and SDR is very similar you can find a link

00:56:50 to a zero cost nsdr on YouTube it's a 10 minute long one there are also 20 and 30 minute ones out there also on YouTube but I'll provide a link to the 10 minute one those have been shown to increase the amount of dopamine in your dopamine Reserves by up to 65 percent which is a remarkable number so quality sleep non-sleep deep breath AKA Yoga Nidra very powerful ways to keep your Baseline level of dopamine at a sufficient level in addition to that nutrition no doubt plays a role in your Baseline level of

00:57:22 dopamine because tyrosine the amino acid is the rate limiting enzyme For the synthesis of dopamine tyrosine is present in varying levels in different foods you can look those up online you just simply put in a search for tyrosine levels in different foods everything from particular cheeses like parmesan cheese has high levels of tyrosine certain meat certain nuts certain vegetables without getting into details in specifics you can find those there but you need proper nutrition and therefore nutrients in particular

00:57:52 tyrosine in order to have sufficient levels of Baseline dopamine the third thing on the list and again these are things that we come back to almost every episode but I don't think they can be repeated enough because these are really things that we need to focus on every 24 hours you might be able to skip a day here or there if you get sick or you're traveling or you have some major life event but really every 24 hours we need to re-up our sleep we need to re-up our nutrients even if you're fasting you're re-upping

00:58:19 your nutrients from stored sources within your body the third thing is sunlight morning sunlight in particular I've done extensive episodes about this check out the episode on lighting your health if you want all the details but you want to try and view sunlight as early in the day as possible five to ten minutes on a clear day minimum 10 to 20 minutes on a cloudy day minimum 20 or 30 minutes on a very overcast day minimum without sunglasses don't stare at the sun please don't damage your eyes look off slightly off from the Sun but

00:58:50 yes you want to face the Eastward towards the Sun and on those cloudy days that's especially important to do why well viewing morning sunlight increases cortisol early in the day which is excellent because you want cortisol elevated early in the day and you want it lower later in the day and because of the relationship between the cells in your eye that sense sunlight

specifically morning sunlight believe it or not that happens and signal to your hypothalamus and the relationship between the hypothalamus and the

00:59:17 pituitary and other endocrine organs it sets in motion a dopamine-related Cascade in neuromodulators dopamine and hormones that lead to states of well-being elevated mood alertness Etc throughout the day it also helps your sleep at night but today we're talking about dopamine so yes believe it or not that morning sunlight exposure does increase your levels of dopamine not just cortisol and fourth on the list is going to be movement exercise of varying kinds be resistance training could be cardiovascular training that does

00:59:49 increase levels of dopamine here we're not talking about achieving peaks in dopamine right that could be accomplished through setting a personal record a PR or through Sprints or heavy lifts or learning some new Dynamic movement what we're really talking about here is getting into a regular exercise program of if not every day at least five days a week a mixture of cardiovascular and resistance exercise that we also know is known to elevate and maintain an elevated level of Baseline dopamine so it's not just about

01:00:21 the Euphoria you feel during or after exercise it's also about the Baseline level of dopamine that's achieved through regular movement and engaging in movement and if you're asking how could that be well you already know the answer the circuits in the brain and body that generate movement not just goal seeking but movement itself as I mentioned earlier that Niagara striatal pathway and yes that circuit is separate from the VTA nucleus accumbens to cortical circuit the mesocortical circuit that we've mainly been focusing on today but

01:00:53 they interact and so by engaging in regular movement you ensure that you're maintaining elevated levels of Baseline dopamine which is what you want if you're going to be able to engage in any kind of motivated Pursuit behavior of any kind so those are the fundamentals that will set the level of Baseline dopamine in your system a couple of key points yes there is variation based on both genetics and Circumstance in Baseline levels of dopamine if someone's going through a particular hard time or if somebody

01:01:23 inherited a gene in the dopamine synthesis pathway that simply affords them higher levels of Baseline dopamine we likely know these people they seem hyper motivated all the time not just based on prior success but they just seem to have a lot of energy and a lot of go drive you know you talk about activation energy some of you may know what that term means others of you won't having low activation energy is great I mean the amount of energy that it takes to get into action to pursue adaptive and meaningful

01:01:48 healthy goals some people just seem to have lower activation energy and higher levels of dopamine are probably associated with that some of us have lower levels of Baseline dopamine regardless everyone needs to engage in the foundational things that I just mentioned a few moments ago every 24 hours or at least strive to there is no escaping that I'd like to just take a brief moment and thank one of our podcast sponsors which is inside tracker inside tracker is a personalized nutrition platform that analyzes data

01:02:17 from your blood and DNA to help you better understand your body and help you reach your health goals I've long been a believer in getting regular blood work done for the simple reason that blood work is the only way that you can monitor the markers such as hormone markers lipids metabolic factors Etc the impact your immediate and long-term health one major challenge with blood work however is that most of the time it does not come back with any information about what to do in order to move the values for hormones metabolic factors

01:02:44 lipids Etc into the ranges that you want with inside tracker changing those values becomes very straightforward because it has a personalized dashboard that you can use to address the nutrition-based behavior-based supplement-based approaches that you can use in order to move those values into the ranges that are optimal for you Your vitality and your longevity inside tracker now includes a measurement of APO lipoprotein B so-called APO B in their ultimate plan apob is a key marker of cardiovascular health and therefore

01:03:12 there's extreme value to knowing your apob levels if you'd like to try inside tracker you can go to insidetracker.com huberman to get 20 off any of inside tracker's plans again that's inside tracker.com huberman to get 20 off now there are things that can increase one's Baseline level of dopa being further and some of those get us into the realm of supplements and prescription drugs but for now I just want to mention a few of them that are purely behavioral in nature are zero cost and that have been

01:03:41 shown in the research literature to increase Baseline levels of dopamine for long periods of time and this is important because if any of you are out there listening to this thing about Peaks and troughs and bass lines you might be asking wait what's the difference between a Baseline and a peak really because if for instance you get a big peak well that's a peak in the Baseline so how do you distinguish between Peak and Baseline and well there's a trough and let's say that trough lasts an hour is that hour-long

01:04:11 trough for your baseline or you know where's your set point how do you establish your set point or more importantly how do you raise your set point ah well if you're not already asking that question I just asked it for you I Define an increase in your Baseline level in dopamine to be anything that increases dopamine for more than one hour you know when we think about

cocaine and amphetamine pornography sex caffeine things of that sort regardless of how long one engages in about of those behaviors or

01:04:40 substances the increases in dopamine are going to be relatively short-lived on the order of minutes to an hour sometimes longer now I didn't say that's how long you're engaging in the behaviors I said that's how long those increases in dopamine are going to occur even if you were to continually engage in those behaviors and remember with continual engagement in a dopamine spiking Behavior a behavior that increases dopamine Peaks the height of those Peaks remember gets lower and lower and lower especially in

01:05:06 a short amount of time and then drops below Baseline there are tools and techniques that you can use to elevate your Baseline level of dopamine for long periods of time and here again this is done in addition to the basic tools that I mentioned a few moments ago the simplest one for which there are excellent data and here I'm referring to data published in the European Journal physiology I'll provide a link to this is that exposure of your body up to the neck to cold water and it doesn't have to be

01:05:36 super cold by the way to cold water has been shown to increase Baseline levels of dopamine and the other so-called catecholamines which include norepinephrine and epinephrine but for sake of today's discussion dopamine in particular for not just one but at least two and probably as long as four or five hours there have been some additional scientific studies after the paper I just mentioned and it's really remarkable you can accomplish this a number of different ways you could get into a cold shower in

01:06:05 the morning and I do recommend doing this in the morning and in that case it's okay to get the water on your head in fact I recommend it uh you could get into an ice bath you could get into a cold Plunge in these circumstances I'm not suggesting this for sake of increasing metabolism or fat loss and the whole discussion around uh deliberate cold and metabolism and fat loss has become a little bit controversial so we won't go there now mostly because we're focused on the clear ability of deliberate cold

01:06:31 exposure to increase dopamine for long periods of time AKA your dopamine Baseline the ways to do this vary depending on the temperature so for instance there are data pointing to the fact that if you want to get a long lasting increase in your Baseline dopamine you could take a very cold shower or cold plunge or ice bath for a very brief period of time anywhere from 30 seconds to two minutes maybe three minutes but probably 30 seconds to two minutes now you might ask what is very cold you have to be careful because

01:07:00 I don't want to recommend anything that's going to cause anyone to have a heart attack or go into shock or anything of that sort it's going to vary by person depending on your level of cold tolerance what I recommend is if you are going for the short exposure long dopamine release approach that is 30 seconds to two minutes that you start warmer than you think you need to and then you ease into it over a few days but we're really talking about ranges in temperature from anywhere from about 37 degrees Fahrenheit to about 55 degrees

01:07:32 Fahrenheit again be careful approach it with caution and ease into it I do recommend doing this early in the day and I should mention not after strength or hypertrophy training because within the six hours after strength or hypertrophy training this deliberate cold exposure especially immersion up to the neck can suppress the strength and hypertrophy adaptation that the training is designed to accomplish okay so that's one approach the other approach that's supported by the literature to increase

01:07:59 Baseline levels of dopamine for very long periods of time in fact this is the original approach is to get into warmer water so not warm but warmer so 60 degree Fahrenheit water up to the neck and to stay there for about 45 to 60 Minutes the reason I don't think most people will do that or that most people would prefer a shorter colder exposure protocol is that most people don't have 45 to 60 minutes each morning to get into water and sit there and in that study they actually had them sitting in lawn chairs basically in the

01:08:29 shallow end of a pool up to their neck for a full 60 minutes and then measuring dopamine release and so forth so there are a bunch of different ways to do this I should emphasize I don't think you need to be super precise about the temperature and even the duration what I recommend is find a temperature that's uncomfortably cold to you meaning that you feel agitated you want to get out but that you're confident you can safely stay in and again I can't give a simple prescriptive to everybody but this is

01:08:53 known to increase Baseline levels of dopamine significantly in fact double them or more for long periods of time meaning hours up to four maybe even six hours into the day which is one of the reasons I suggest doing this early in the day I happen to get into a cold plunger take a cold shower first thing in the morning I do go outside and get my sunlight first sometimes sometimes I do the cold first it really depends on my circumstances and how I'm feeling that day I don't think it really matters

01:09:18 which one you do first but you want to try and get both of those in early in the day because you really want the catecholamines and cortisol elevated early in the day okay so that's deliberate cold exposure we already talked about exercise so if you're doing your exercise early in the day there's no reason why it couldn't be done in concert with this deliberate cold exposure I

recommend doing the deliberate cold exposure first for the reasons we talked about a few minutes ago and then of course there are

01:09:40 compounds both prescription and over-the-counter compounds that can indeed raise your Baseline levels of dopamine for an hour or more and when I say an hour or more it really depends on individual variation in terms of how quickly you metabolize dopamine and it depends on individual variation in how you manage or tolerate different dosages of drugs and different types of drugs so the typical drugs and here I'm talking about legal prescription drugs for increasing dopamine are things like Ritalin

01:10:11 Adderall modafinil and arm modafinil also tap into the system and I did an entire episode about ADHD which is the typical context in which you hear about these prescription drugs but assuming it's prescribed by a doctor for either clinical reasons like ADHD or for other reasons all of those compounds do significantly increase Baseline levels of dopamine for many many hours that's absolutely clear and it's one of the major reasons why those drugs are so effective in increasing motivation and attention then there are compounds that

01:10:39 are sold over the counter things like amino acids such as l-tyrosine itself that's a very commonly sold and used amino acid it's present in a lot of so-called pre-workout formulas I as many of you know am a fan of single ingredient supplements for the most part aside from foundational supplements like ag1 which give you many many micronutrients kind of all together because it would be nearly impossible to consume each of those as individual ingredients and get the right amounts Etc but for all other supplements I'm a

01:11:10 big believer in parsing what you need and what's most effective for you in single ingredient formulations and the typical ways in which people work to elevate their Baseline levels of dopamine with supplements are using either l-tyrosine which as I mentioned earlier is the rate limiting enzyme for dopamine or by using what's called mucuna purines which is actually very similar to l-dopa which is the treatment for Parkinson's mechuna purines actually comes from the velvety outside coating of a certain

01:11:39 bean I know it sounds really esoteric but that's actually where it's found in nature and it's really 99 l-dopa and I confess having tried McCune appearance having examined the scientific literature on the cune appearance there is some evidence that it can increase dopamine especially in that tuberinfrendibular pathway because it can tap into some of the hormone-related functions of the pituitary it does increase alertness and mood it might even increase libido motivation Etc but the effects of mercuna purines tend to

01:12:11 be very much of the increasing the peak in dopamine and then very quickly dropping that peak in other words the peak trough phenomenon not for increasing Baseline levels of dopamine now it's likely different for people with Parkinson's who are taking prescription drugs that are similar to mercuna purine so if people have Parkinson's oftentimes they are prescribed things like l-dopa which is in the pathway to dopamine synthesis or they are prescribed things like bromocriptine which will indeed increase

01:12:41 dopamine and I do realize that some people use those prescription drugs recreationally which I don't recommend those drugs can be used to increase Baseline levels of dopamine but more typically they cause Peaks and dopamine and troughs and dopamine which is why I do not recommend them they are not going to allow you to accomplish what you want if your goal is more motivation Etc in fact they are likely to do the opposite give you a big peak an alertness and then a crash that can include depressive symptoms and just not

01:13:10 feeling very good l-tyrosine however has been examined in the scientific literature and at reasonably low dosages has been shown to increase circulating and available levels of dopamine both in the brain and body and lead to increased cognitive performance and in some cases physical output I'll provide links to a few of these studies but the two that I really parsed most finely for sake of this episode really just focus on taking l-tyrosine under conditions where your Baseline levels of dopamine are reduced

01:13:40 due to stress and under conditions where there's no stress and people are trying to increase their Baseline levels of dopamine for sake of improving cognitive function the first paper is entitled effective tyrosine on cognitive function and blood pressure under stress I'll provide a link to this in the show note captions and it's one of many papers really dating back to the early 90s exploring how relatively High frankly relatively High dosages of l-tyrosine Taken under conditions of stress allow people to

01:14:09 rescue some of their cognitive function in terms of working memory tasks and other kind of cognitive tasks visual Pursuit tasks and so on the second paper is entitled tyrosine improves working memory in a multitasking environment and the second paper is perhaps more interesting because it involves exploring the use of tyrosine supplementation basically taking tyrosine about an hour before a cognitive task or set of cognitive tasks that involve a lot of multitasking and working memory working memory for those

01:14:35 of you that don't know is your ability to maintain small batches of information in your mind for relatively short periods of time so for instance if I tell you my phone number or the phone number where I grew up 493-2931 if you can remember that chances are you'll remember it for 30 seconds 60 seconds but that you won't remember it tomorrow because there's really no reason to a

lot of the tasks that we do throughout the day involve working memory and working memory is very subject to interference from other tasks

01:15:03 that we happen to be doing like looking at our phone or having a conversation or trying to navigate through a city it involves a lot of attention and this study shows that tyrosine improves working memory especially in the context of multitasking and having a lot of conflicting goals and they did a number of really nice experiments here it's again it's a small study not that many subjects but it's one of several papers in fact this is the paper that kind of set in motion the Domino of other papers

01:15:28 exploring the efficacy of L-tyrosine for cognitive performance and they looked at working memory tasks of course but also auditory visual tasks and they involve some interference of visual cues and things of that sort and they saw some really interesting effects basically when we need to attend to multiple things at the same time L-tyrosine can help us do that at least as it relates to memory when I say althyrosine what I really mean is having your Baseline levels of dopamine elevated can really

01:15:59 help navigate multitasking environments especially as it relates to working memory and this is true under conditions of stress and under conditions of not stressful okay you might say well isn't multitasking stressful itself yes it can be but when we talk about under conditions of stress we're talking about people who are sleep deprived we're talking about people that are under other kinds of psychological or physical stress L-tyrosine can help in that context as well so as I mentioned before in these studies they use very high

01:16:26 dosages of L-tyrosine so high that actually I don't recommend them they did measure stress hormones they did measure blood pressure and things of that sort but I want to caution you I do not recommend I will say it again I do not recommend following the dosages that were used in these two studies because they are exceedingly high they used 100 milligrams per kilogram of body weight of tyrosine one hour prior to these cognitive tasks now I weigh about 220 pounds I'm a little bit lighter than that so that's a hundred kilograms

01:16:58 approximately translated from this study that would mean that had I participated in the study and I wasn't in the placebo group but I was in the L-tyrosine group I would have been given 10 000 milligrams of L-tyrosine which is 10 grams of L-tyrosine I do not recommend that in fact there are papers showing that as little as 500 milligrams but perhaps up to one gram that is a thousand milligrams or 1500 milligrams a gram and a half of L-tyrosine Taken 30 to 60 minutes before a cognitive or physical task can increase Baseline

01:17:33 levels of dopamine for extended periods of time and thereby improve performance on those mental or physical tasks so if you are somebody who's interested in trying l-tyrosine please know that the increases in Baseline levels of dopamine can be substantial they are long lasting which qualifies them as Baseline increases as opposed to Peaks and I would say you should also start with the lowest possible dose so for most people 250 to 500 milligrams is going to be a reasonable starting dose depending on

01:18:02 your body weight smaller people start with 250 larger maybe 500 keep an eye on whether or not you're combining it with caffeine or with any other stimulants and keep in mind that again the bigger the peak in dopamine the bigger the trough in dopamine afterwards so pay attention to whether or not you experience a crash that same day or the next day but chances are if you're using a relatively low level of l-tyrosine so anywhere from 250 maybe 500 milligrams or a thousand milligrams of l-tyrosine

01:18:30 prior to cognitive or physical work and taken early in the day by the way because this can act as a bit of a stimulant that you're going to achieve these long lasting increases in Baseline dopamine but please also keep in mind that that I always always suggest that you engage in the proper behaviors and you disengage from the improper behaviors as a first line of offense on any health goal so now you know how to set your Baseline levels of dopamine at the highest possible level you of course want to guard that

01:19:00 Baseline level of dopamine very carefully so for instance you want to avoid any kind of behaviors or substances that are going to Peak your Baseline level of dopamine very high or very sharply or if you do engage in those types of behaviors whatever they may be that you are well aware that your Baseline level of dopamine will drop far below what it was after that Peak has fallen you will be essentially in the quote unquote trough if however you find yourself in that trough you now have the knowledge to

01:19:31 understand that that trough will resolve if you wait enough time that Baseline level of dopamine that you were at prior to the peak will come back you will feel better however most people don't know that and as a consequence when they feel that low that is they feel kind of a motivated maybe a little bit depressed maybe a lot unmotivated or a lot depressed following some quote unquote Peak experience what they end up doing is thinking about what caused that Peak experience and then go back and try to re-engage in the

01:20:04 behavior and try and regenerate that Peak experience but you now know that that is a terrible strategy in fact that strategy will only lead to diminished Peaks from the same experience it will lead to in many cases pursuing more and more intense experiences to try and recapitulate recreate that big peak which won't work or even worse people start stacking and combining

different dopamine increasing behaviors in order to try and obtain something like that initial Peak when in fact all they need to do all you need to do is simply wait

01:20:39 because the way that the dopamine circuitry is arranged is that it's not just about pleasure as you know it's about motivation desire Pursuit and pleasure and it also has everything to do with pain and discomfort now when people hear the word pain they often think oh pain okay so a physical pain or an intense emotional pain but today we're going to talk about pain a little bit differently we're going to talk about the pain associated with the trough and dopamine that occurs after a big peak in dopamine

01:21:08 as a period in which pain and effort go hand in hand and I'll return to this in a moment but I want you to just note that in your mind kind of earmark that in your mind because what we're about to talk about is how to leverage that pain and to use effort as a way to not just get out of the trough more quickly but actually to get back to a higher level of Baseline as you exit that trough meanwhile I really want to harp on this one point that I made a moment ago which is that after some big experience so it could be a vacation or

01:21:40 a night out partying or the birth of a new child all of these are well-known phenomena that lead to troughs or deficits in dopamine afterwards which can cause a sort of postpartum depression postpartum depression is a phrase normally used to describe literally postpartum post-birth of a child depression and that has many causes not just related to dopamine baselines although it does involve dopamine baselines but it has hormonal aspects and other aspects as well but postpartum depression is also used to

01:22:10 describe any time that our Baseline dopamine has has gone down way way below what it was prior to some recent Peak or exciting exhilarating win or behavior couple of things that one can do in order to get out of that trough more quickly the first one is simply to wait with the understanding that you will get out I know that sounds overly simplistic and maybe a little bit brutal but I think most people don't realize this they don't realize that the dopamine circuitry does take time to replenish and it has everything to do with

01:22:41 restoring both the synthesis of dopamine as well as What's called the readily releasable pool of dopamine so dopamine is packaged in these little spherical things that we call vesicles those vesicles are released from the ends of nerves so in this case we're talking about the nerves that originate again and VTA and nucleus accumbens and send their little wires up to the prefrontal cortex and that's where dopamine is released and that readily releasable pool of dopamine takes time to replenish and

01:23:09 that can take several days in order to replenish just knowing that can help you through that process and of course then it raises the question is there anything that you can do to accelerate that process and indeed there is and indeed this is what I consider not just something to get you out of a trench of kind of lower mood and motivation but actually what represents the Holy Grail of motivation today I'm going to talk about this pain effort process as a very powerful way to get out of sticking

01:23:38 points but more importantly to get into a mode where effort and reward can actually accelerate your progress along any path to any goal and in a way that you can do it repeatedly and this is not simply taking mechanisms from biology and painting names on them rather this is leveraging mechanisms in biology that are well defined in the animal and human in literature that have parallels to the addiction and addiction recovery literature but that have been shown in specific circumstances to really allow

01:24:08 people to engage in motivational Pursuits in a variety of context School relationships work etc in an ongoing way and in a way that never depletes their Baseline of dopamine to the point where they have to do a lot of extra work to get it back and in a way that allows them to be really motivated in a variety of contexts in an Adaptive way so what we're really talking about here is regardless of your genetics regardless of who your parents are which obviously you couldn't select being able to leverage your dopamine

01:24:37 system in order to be maximally motivated when you want to be and indeed to avoid procrastination I'd like to tell you about a classic experiment that I've described once before on this podcast but frankly this experiment is so crucial I don't think it can be described enough this was an experiment that was done at Stanford many years ago and involved children but it's actually been repeated in adults the experiment involved observing a classroom of young children so these were kids about kindergarten age a

01:25:07 little bit older and observing which activities kids like to do in their free time so their structured time where they had to you know these are little kids so they play blocks or they had to um sing or they had to write or or do what they could or I suppose draw they're probably not writing um significant prose at that age but then they had free time where they could do whatever they wanted and what the researchers did was observe the children who selected by their own choice to draw pictures so there were some tables out

01:25:34 with crayons and markers and paper Etc and there were some kids that would just naturally go to that activity every day because they liked that activity and they measured how much of the free time these children elected to use their free time drawing doing these different art projects and then what they did was they started introducing rewards to these children they started

putting a gold star or in some cases a silver star on their pieces of artwork and telling them what a good job they did and the kids really liked

01:26:05 that in fact who wouldn't right they're not only doing an activity that they like but they're also getting a reward for it so you can probably see where this is all going what they were doing was they were increasing the amount of dopamine that these children experience and again in parallel experiments done with adults if you take adults who enjoy a particular activity you let them do activity and then you start rewarding them for that activity especially when you surprise them with a reward for an

01:26:28 activity they already like they report that being a much more pleasurable experience than had they just done the activity then what they did with these children and in the experiments with adults done later on was they cease giving them the reward and then they observe what percentage of their free time they spend doing that activity drawing and what they observed was you guessed it a drop in the total amount of time that the children elected to do this activity that initially they were doing quite a

01:26:58 lot in other words their total satisfaction or desire or motivation to engage in this activity drop below what it was prior to ever receiving a reward and again this has been repeated in a variety of contexts in different populations different cultures different countries men women boys girls lots of different backgrounds so what this tells us is everything you already know which is that reward prediction error is not just about the desire to do something and you carrying it out and it being pretty good

01:27:28 amazing or not good okay I always like to joke that the nervous system sort of codes things into three bins you can think about this in terms of food or any type of experience it can either be yum yes I really like that yuck I really don't like that or meh it's kind of so so what the scenario led to where rewards were received for an activity that people already like to do and then removed was that an activity that at one point was a yum becomes a meh and that all reflects a drop in Baseline dopamine

01:27:59 why because the activity that the children or adults liked combined with the gold star or the monetary reward or praise that children and adults seem to like compounded to create a bigger peak in dopamine and therefore a bigger trough in dopamine and if you're already wondering whether or not their desire to engage in that activity eventually came back it did indeed so essentially what I described all matches precisely with dopamine reward prediction error and the fact that peaks in dopamine give rise to

01:28:31 subsequent troughs and dopamine that if one waits long enough allow baseline levels of dopamine to return to normal and of course the amplitude of that dopamine peak has been varied by giving more money or less money in different scenarios nearly all the different derivations of the experiments that you could imagine that map onto the dynamics of dopamine release that we've been talking about during this episode all played out exactly as one would have predicted based on the neural circuitry and the dynamics of dopamine I recommend

01:28:58 that you leverage this knowledge to make sure that any activities that you enjoy to do whether or not you enjoyed a little or a lot but especially if you enjoy it a lot that you guard and protect by making sure that you don't start layering in or attaching reward or other sources of dopamine releasing behaviors or substances to that specific behavior or if you do that you don't do it terribly often now how often is terribly often we'll get to that in a moment but let me give you an example from my life just as an example but you

01:29:33 will likely have and you'll know people that will have different examples I love to exercise I know to some people uh this might seem foreign but I love to exercise I love to do resistance training I love to run I am not one of those people that doesn't like the experience of exercising but likes the feeling afterwards quote unquote I hear that a lot I don't like to exercise but I love the way I feel afterwards I love physical training and I love the way I feel afterwards but I mostly love the feeling during I don't know why I'm

01:30:05 wired that way I can't say that I'm somebody who likes to do hard things across the board there are plenty of difficult things in life that I dread or that I'm sort of meh about but for me hard exercise intense exercise of a particular kind resistance training and running in particular both give me a yum yes I love this kind of feeling and yes it persists for me quite a long while afterwards both for sake of the way that it changes my neurochemistry but also my sense of satisfaction but I just simply love it

01:30:36 now years ago I discovered that if I drink a cup of black coffee or an Americano or a double espresso or some yerba mate that my workouts can be quite a bit more intense I can run further and then I also discovered that if I were to take a pre-workout energy drink or I took say 300 milligrams of alpha GPC and 500 milligrams of phenylethylamine and perhaps even 500 milligrams of L-tyrosine and perhaps did that alongside the caffeine in the Yerba mate then yes absolutely I really like those workouts I could be like a laser in

01:31:11 terms of focus I could exert even more effort put on some music and I could achieve even better performance and then I also discovered that I could export that protocol of caffeine yerba mate and various supplements to my cognitive work so I was when I was studying or writing papers or writing grants or in the laboratory when I was doing experiments with my hands in those

days you know cutting brain tissue and staining it and working really long hours and I discovered that all of those things all of those behaviors compounded

01:31:40 with my love of exercise and my love of doing science and gave me these big peaks in what to me felt like even important experiences they felt you know unlike anything else they were just so so peak in their nature which was great and it did indeed enhance my performance however while it did not create a dependency for those different substances caffeine supplements Etc what I noticed was that in the days and sometimes weekends afterwards even though for much of my career I confess I've worked weekends as

01:32:15 well but I would notice that I'd experience a real trough in energy I just would not feel that good and then if I kept up those behaviors consistently and I was consistently adding in these other let's just call them what they are dopamine releasing or stimulating behaviors and substances that my enthusiasm for physical training or running or for doing experiments actually started to diminish and this was really discouraging to me at the time because I started to think okay maybe I'm burnt out maybe I have adrenal burnout which

01:32:45 by the way doesn't exist folks your adrenals don't burn out there is something called adrenal insufficiency syndrome you can over stimulate your system by way of too much adrenaline epinephrine and norepinephrine but that's a separate thing there's no such thing as adrenal burnout per se but I didn't know that so I thought gosh I'm really burnt out when in fact it's now obvious to me what I was doing I was combining too many dopamine releasing or stimulating behaviors in substances for things that I already

01:33:14 enjoyed doing as behaviors namely exercise and doing experiments anything related to science actually so what this means is not to avoid taking things or doing things that amplify your amount of dopamine but to be very cautious about how often one does that and how many different dopamine stimulating behaviors or compounds one stacks especially in terms of taking those things or stacking those things in and around behaviors that you already really enjoy doing I was essentially just creating another version of the

01:33:49 kids in nursery school or first grade with the gold star experiment I was basically just doing the exact same thing and when I realized that and I changed my relationship to those compounds I didn't eliminate them all together but I started realizing for instance that I didn't need to double up on yerba mate and coffee every workout sometimes I would do one sometimes I would do the other frankly I always do one or the other it's rare that I ever do any kind of physical training without some caffeine first and I do my physical

01:34:20 training typically in the early part of the day so that's fine doesn't interfere with my sleep I might do a hike without caffeine but if I'm in a weight trainer I'm going to run I tend to drink coffee beforehand or have yerba mate or if I occasionally meaning about once every third sometimes every other but usually about every third workout I'll take 300 milligrams of alpha GPC maybe occasionally maybe every third or fourth workout and these are resistance workouts mind you not running I'll take

01:34:51 500 milligrams of L-tyrosine or more typically 500 milligrams of phenol ethylamine and very very rarely maybe once every two or three months I might stack all of those things together prior to a workout but of course I'm always mindful to also include workouts or runs or bouts of cognitive work so that could be grant writing prepping for a podcast Etc where I don't do anything prior maybe just my caffeine because I have a baseline level of caffeine that I use each day to function like many people

01:35:19 there's a baseline level of caffeine that just allows us to function if we're a Perpetual user of caffeine I talked a lot about this on the episode in caffeine but the key here is be cautious I would say be very cautious about stacking and layering in too many dopamine Peak inducing behaviors all at once on a regular basis the key Point here is if you are somebody that can engage in these intrinsically joyful activities for you these activities that you're really motivated to do whether or not it's skiing or playing music or

01:35:49 dancing Etc without the need to layer in additional dopamine releasing mechanisms or compounds or activities well then I highly recommend you do that because then you are essentially making yourself one of those fortunate few that does not require additional stimuli and therefore can hold on to that pleasure can hold on to that intrinsic pleasure and motivation to engage in these behaviors over time which frankly there is no replacement for there is no pill or bottle or potion or motivational speech

01:36:22 or podcast or book that can replace intrinsic motivation intrinsic motivation is perhaps the Holy Grail of all human Endeavors and behaviors because it encompasses so much of what brought us to this point in our species Evolution and also what brings each and every one of us closer and closer to our goals and if it's happening with enjoyment without the need to layer in additional tools well then you have really tapped into the source and when I say the source I don't mean it in any kind of mystical way I think it's quite

01:36:53 clear by now that when we hear about Chi from Eastern medicine or we talk about motivation drive and pursuit in on Western neurobiological languages that relates to dopamine or we hear about the source maybe in my podcast episode with the one and only Rick Rubin incredibly productive music producer who's as an just an unbelievable track record in terms of creative

Endeavors and he talks about the source we're really talking about the same thing which is this set of circuits within us that allow us to identify what we want and

01:37:26 then lean into effort and then to do that in a persistent way that allows us to reach our goals and if we can do that with an intrinsic sense of pleasure well that is nothing short of magic but of course it's not magic it's science and of course most people are not concerned about trying to protect the things they already enjoy in order to make sure that they can continue to do those things and enjoy them most people are thinking about how they can engage and pursue things that are less than pleasurable to

01:37:56 them or how they can continue to engage in motivated behaviors when the going gets tough or and this is a big one I hear this over and over again as a request to cover on this podcast how people can overcome procrastination what we're going to talk about now is how the Dynamics of dopamine release that you already are aware of plus and additional Dynamic that we haven't quite talked about can allow you to leverage dopamine in a way that really will bring you to the Holy Grail of motivation and drive

01:38:27 which is when effort starts to become the reward itself in other words when friction becomes the reward I know that sounds crazy to some of you but when friction becomes the reward you can pass from an idea and a goal no matter how daunting to successful completion of that goal while experiencing what essentially will feel like pleasure the entire time now that doesn't mean it will be Bliss the entire time but what is very possible is to leverage the Dynamics of both dopamine Peaks and dopamine troughs

01:39:02 in order to not just maintain your Baseline level of dopamine but to also pull yourself out of any kind of procrastination or other kind of overthinking trenches very quickly and get back into a mode of pursuit so how do we make effort the reward you may have heard about this in the context of so-called growth mindset growth mindset is the incredible Discovery and research papers from my colleague Dr Carol dweck in the psychology department at Stanford and there are others such as David Yeager at the University of Texas Austin

01:39:34 who have leveraged the so-called growth mindset as a tool that young people and adults alike can use in order to get better at anything and the basic Contour of growth mindset is to adopt the mindset that if you can't do something or if you can't do it well that you can't do it or can't do it well yet it's that word yet that's really key and there are a number of different tools and techniques that people use to adopt growth mindset but it all starts with that relationship to not being able to do it yet now that all sounds pretty

01:40:08 straightforward when you tell yourself but when we are in a performance context when we expect ourselves to be able to motivate or when we expect ourselves to be able to perform and we can't that often sets up a downward spiral of motivation because we are so used to being attached to the relationship between desire motivation and outcomes reward prediction error we want something we want that a in class or we want to learn how to dance or we want to be able to do this uh physical skill of another kind

01:40:42 or learn a language or get the mate we desire or make the relationship work or make the business work on and on and then we get the outcome that we don't want and our confidence for lack of a better word drops over time oftentimes that leads to situations where we are not motivated we are a motivated it can even lead to situations where we are downright depressed there's also circumstances where people myself included of course procrastinate we know we should do something but somehow we can't get motivated we know

01:41:14 that if we put in the effort we'll get there but we can't do it either because we don't like the activity or we're just not feeling great now we could be quote unquote not feeling great not feeling motivated because our dopamine Baseline is low and so I absolutely encourage everybody to take a look at themselves anytime they're in a motivated State take a look at the landscape of their life not just at that moment but in the preceding days and weeks and ask whether or not you've been tending to those foundational things we

01:41:42 talked about earlier whether or not you are engaging any other of the tools that we talked about earlier to see if you can get into a motivated State however if all of those boxes are checked you answer yes I'm doing all those things I'm just not motivator I'm just whatever reason I just procrastinating I don't know I don't want to do it or I'm not feeling motivated well then there's a very potent set of tools that you can leverage to overcome states of lack of motivation overcome procrastination and indeed can help you

01:42:09 deal with things like overthinking as it relates to procrastination and lack of motivation as well so the way this works is the following if you recall a peak in dopamine is followed by a trough in dopamine that trough in dopamine is experienced as pain or wanting or craving that pain that I'm referring to is actually a craving or a wanting and it's a craving you're wanting for a specific state that you would like to achieve that is different than the one that you're in you want to get out of that trough and as you recall from

01:42:44 earlier in the episode that trough is the stimulus for the ongoing release of dopamine that provides the propeller the motivation to go forward and seek some goal okay so when we are not motivated when we are in a so-called a-motivated state or when we are procrastinating or when we just sort of can't seem to get in gear the key to getting out of that pain

trough is one of two things I already told you earlier you can just wait you can wait till your motivation comes back and a lot of people do wait in fact they

01:43:15 procrastinate they start doing other things that are less painful than the state that they happen to be in when they are you know trying to get into gear to go work out because I realize not everyone wants to do that or to study or to have a hard conversations whatever it is and what do they do they start engaging in activities that we and indeed they would not consider pleasureful activities they start for instance cleaning the house so seemingly out of nowhere they start engaging in these activities that normally are not

01:43:43 intrinsically pleasureful for them they're not highly motivated to do them as a replacement for doing the very thing that they quote unquote need to do or ought to do and that they're procrastinating to do what they're essentially doing here is a mild type of addiction replacement in other words rather than be in the painful State and wait for it to pass they're doing things that give them some sense of accomplishment ostensibly to give them the sense that they're completing things and perhaps and I

01:44:13 don't know because I'm not um in the psychology of knowing what other people are thinking perhaps in order to generate the momentum in order to get engaged enough or motivated enough to study or work out or whatever activity it is that they're trying to avoid through procrastination now what's interesting about this Dynamic is first of all it's extremely common and second of all a lot of people will use this as a tactic so that they get very close to the deadline to complete something and then they go into a sort

01:44:42 of pseudo panic and then use anxiety as a way to leverage their mental and physical resources to complete that thing how do I know the Contour of this so well how do I understand the inner dynamics of it well part of that relates to my work as a neurobiologist and reading the papers that I'll mention to you in a moment but it also relates to the fact that I'm somebody who Waits quite a while right up until the sort of last minute possible to complete something for activities that I don't want to do something I've been working

01:45:12 on my whole life in any case I'm very familiar with the procrastination process so how can we overcome procrastination well it turns out that there are findings from within the addiction literature that turn out to be very powerful towards leveraging our way out of procrastination and it has to do with this you already know because I've told you probably a dozen times now that the depth of the trough after a dopamine Peak is proportional to how high that Peak was and how steep it was how quickly that Peak occurred it turns out

01:45:43 that not only is the depth of the trough proportional to that but the rate at which you get out of that trough is proportional to how steep that trough is let me explain this for you in as clear terms as I possibly can imagine you're in an a-motivated State you're just not feeling motivated you're procrastinating you may think okay the thing to do here is something I'll clean the house I'll take care of some bills I'll do something or I'll just wait those approaches as we talked about before generally don't work or at least don't

01:46:18 work quickly or they lead you right up to the deadline and that's the deadline that forces you to get something done or you just don't get it done and you don't succeed in your goal that happens a lot as well however if you were to take that state of being unmotivated or procrastinating and actually do something that's harder than being in that a-motivated state in other words doing something that's more effortful even painful you can rebound yourself out of that dopamine trough much more quickly so

01:46:50 what do I mean you want to put yourself in a state that's worse than or harder than the state that you're in or do something quote unquote more painful and here I want to be very clear I'll say this three times but I'm going to say it for the first time now when I say more painful I do not mean doing any kind of tissue damaging or psychologically damaging Behavior or anything of that sort that's going to render you injured or not well even in the short term that's not what I'm referring to okay

01:47:15 let's just get that one out of the way what I'm referring to is the fact that for instance if you're feeling a motivated but you find yourself cleaning the house as a way to procrastinate you can say well cleaning the house is harder than sitting down and doing nothing but actually in that moment or in those moments that's not the case or else you wouldn't be doing it the reality is that the dopamine system works according to what feels hard or easy in the Moment In other words if you're feeling a motivated you

01:47:48 need to do something and put yourself into a state that's harder than the state you're in so for instance if you're sitting around feeling a motivated or you find yourself tending to tasks that are irrelevant to the goal that you really should be focused on you need to put your body and mind into a state of discomfort quickly and the way to do that is to either engage in some tangential activity meaning an activity not related to your goal that puts your body into a very different state so here again I'll

01:48:19 default to the obvious one which is something like cold shower or cold immersion which not only increases dopamine long term or over several hours rather but for most people is experienced as pain that pain causes a rebound out of that dopamine trough faster than it would occur if you had just stayed in that a motivated State and waited for it to go away or done something

like cleaning up that for whatever reason felt like it required less friction when I say friction I mean limbic friction your limbic system is

01:48:50 always in this dialogue with your forebrain and limbic friction goes two ways limbic friction can be you're tired and you don't want to do something and so you have to quote unquote motivate to do it energize yourself to do it or limbic friction can be that you're nervous and scared and anxious to do something and you have to calm yourself in order to lean forward into action in order to do that thing despite the anxiety I realize this can be a little bit confusing as a concept so I want to go into a bit more detail let's

01:49:16 imagine that you or somebody else does not like to exercise you don't want exercise and you're trying to get your minimum of five days per week exercise and you're just not motivated to do it there are a couple different techniques to doing this assuming you've taken care of all the Baseline stuff all the foundational stuff we talked about earlier and you're just not getting in gear and you find yourself you know checking your phone or maybe you're tending into some tasks obviously those things are quote unquote easier for you

01:49:44 meaning they cause less limbic friction than engaging in exercise the typical advice would be just exercise for one minute okay just get one minute of exercise or five minutes and then use the successful completion of that one or five minutes as a milestone that allows you to then move to the next Milestone and indeed that approach can work and it's exactly what I'm describing here when I say that you're in a state of lack of motivation or procrastination or both and you need to put yourself into a more painful not

01:50:19 less painful state so what do you do you push up against that friction and you exercise for a short while and then that pops you out of that trough that's possible but for a lot of people even that won't be possible because they just can't get motivated or they do that one minute or five minutes and they're just like okay I'm still in the trough I'm not actually feeling that great in those circumstances it makes sense to do something that's tangential to the whole path that you're trying to pursue

01:50:46 this goal that you're trying to pursue that is Believe It or Not much worse than just being a motivated and when I say worse I don't mean picking some task that normally you don't like to do but now you're willing to do I mean literally thinking about what would be worse than being in this state again without causing yourself tissue or psychological damage what would be worse well cold water would be worse for many people very cold water so the key is to figure out something that for lack of a better way to put it really sucks really

01:51:18 sucks and yet is safe and by doing that you steepen the trough you steepen the slope of the trough which we know brings you back to your Baseline level of dopamine more quickly now for some people that will be deliberate cold exposure through cold shower ice bath and I have to tell you that if you're cringing as I say this well then there you go you now have a tool that you know you cringe even when you just think about and therefore represents a great tool for you so if I'm procrastinating to do something I

01:51:48 really need to do should I just simply wait for that procrastination to evaporate no will it eventually evaporate maybe will a deadline eventually surface that will trigger me into an anxious or activated state that will allow me to complete what needs to be done maybe hopefully but better would be to get out of that a motivated state that state of procrastination quickly and to do so you need to leverage something that's painful so for instance I heard a beautiful lecture recently done by Dr Anna Lemke at Stanford School of

01:52:21 Medicine discussing dopamine and some of the things in her book and some newer findings as well and somebody in the audience asked her the question does meditation increase dopamine now earlier we talked about how non-sleep deep rest In Yoga Nidra has been shown in the scientific literature to increase dopamine but I also mentioned earlier that classic forms of meditation whether eyes open or eyes closed so-called open monitoring or closed monitoring meditation sitting there lying there and focusing does not increase dopamine

01:52:50 levels per se however for most people especially people who find it hard to meditate or who don't do that practice very often meditation is effortful getting into meditation and staying in meditation is effortful so if you find yourself in a state of procrastination oftentimes a brief five to ten minute meditation where you absolutely do not allow yourself to do anything besides close your eyes focus on your breath and when your mind drifts get back to your breath is not only extremely difficult and extremely

01:53:23 frustrating unless you're a well-practiced meditator but it's often difficult and frustrating not just to do but to get into that practice and not just to get into that practice but to maintain that practice for that mere five to ten minutes because it's just not a natural state for us to be in we have to force ourselves so it is effortful in fact it qualifies as a basically available almost anywhere anytime type of effortful activity that if you dislike it perhaps even as much as some people dislike deliberate cold

01:53:52 exposure well then perfect you now have an additional tool in your kit that you can use anytime you are feeling a motivated and procrastinating now there are numerous examples I could give and hopefully there are numerous examples that you're thinking about the key is to have a short list of about five different effortful AKA painful activities that you can employ anytime you're

feeling a motivated or in a state of procrastination keeping in mind that the goal is not what you accomplish inside of that activity although it is

01:54:23 important that you actually engage in that activity I actually have to make myself meditate in that five to ten minute little bout of effortful or painful activity but it's not about achieving an outcome it's about forcing your body and mind into a deeper state of pain and discomfort in other words taking yourself from that trough that you're already in and steepening and deepening that trough because in steepening and deepening that trough we know that the return from that trough to normal and even elevated levels of

01:54:55 Baseline dopamine is going to be faster and more robust and in doing that you will quickly find yourself back into a motivated State because not only does it teach you that doing hard things is possible that's sort of more of a subjective cognitive learning but it actually Taps into the very neurochemical system that allows you to then feel motivated and capable to pursue the larger goal which is the thing you're really concerned about after all so as is often the case perhaps always the case on this podcast

01:55:26 we covered a lot of material we cover dopamine and what it is we talked about the circuitry and the different kinds of circuitry focusing mainly on this mesocortical pathway that is so vitally important to motivation for any goals talked about the relationship between Peaks and troughs and bass lines and the foundational tools that allow us to set and maintain a healthy Baseline level of dopamine as well as ways to protect that Baseline level of dopamine and we talked about how to get ourselves out of states

01:55:55 of procrastination and a Motivation by not just waiting out those troughs in dopamine but actually making those troughs and dopamine steeper by engaging in things that are effortful and things that we really don't want to do in those moments provided that those things are safe we can get out of those dopamine troughs more quickly and back to our dopamine baseline or even above Baseline and we talked about what I really view as the Holy Grail of motivation which is to be able to learn to attach reward to the

01:56:27 effort process itself and to do so by not just understanding but also learning to subjectively recognize and somatically experience release of these different stressful chemicals within our body I realized this was a lot of information and yet throughout I've tried to highlight tools that you can use that range from behavioral to nutritional supplementation tools cognitive tools and keep in mind that all of these different segments of the podcast is always are time stamps so if you feel the need to go back and listen

01:56:54 to any of these in order to get clearer understanding we've made that easy to do so so simply look for the time stamps in the show note captions if you're learning from and or enjoying this podcast please subscribe to our YouTube channel that's a terrific zero cost way to support us in addition please subscribe to the podcast on Apple and Spotify and on both apple and Spotify you can leave us up to a five-star review if you have questions for me or comments about the podcast or suggestions about topics you'd like me

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01:58:12 kits toolkits are summaries and links to specific protocols that you can use that have been discussed on various podcast episodes so we have a toolkit for sleep for neuroplasticity for deliberate cold exposure and much much more to sign up for the newsletter which by the way is completely zero cost go to hubermanlab.com go to the menu scroll down to newsletter and provide your email we do not share your email with anybody thank you once again for joining me for today's Deep dive discussion into dopamine and its

01:58:39 practical applications and last but certainly not least thank you for your interest in science [Music]