Your Questions Answered - Bret and Heather 18th DarkHorse Po...

Sat, 10/9 12:36PM • 1:12:17

**SUMMARY KEYWORDS**

question, y chromosome, genes, model, infection, fact, good, strains, asymptomatic, tests, mechanism, species, point, virus, droplets, find, assumptions, tissue, male, tend

**SPEAKERS**

Bret, Heather

**Bret** 00:07

Hey folks, welcome back to the Dark Horse podcast live stream our 18th. This is the question and answer portion. And we are now going to address your super chat questions starting with the ones from the first hour and continuing on to the ones from this hour. So if you have burning questions, feel free to enter them.

**Heather** 00:27

So as as has been the pattern we will spend about a half an hour on these from the first hour, which we have ranked mostly just by monetary amount not entirely, did a very poor job. And then we'll try to answer the other ones in the order that they come in the second hour. But we're actually going to start with one from last time. We had a lot of good questions last time that we didn't get to because we were focusing on evergreen only questions, there are a number of them I'd like to get back to now. But there was one at a particularly high dollar level that was quite good. So we're actually going to start there already from Martin when the Corinthians migrated into the Americas and the Ice Age and they were effectively isolated from the rest of humanity. How long would the isolation of the Brendan's descendants have needed to continue to lead to a new and distinct species of Homo? So however, NGS?

**Bret** 01:15

That's a great question, which I am not going to dodge so stealthily, I figured you what I will do? So my answer would be the funny thing about humans is that human populations function like species in other clades. And so in a sense, it doesn't take any time at all, if what you're really looking at is whether they behave differently enough that we would justify such a claim. On the other hand, if you're asking, how long would it take for the genetic isolation, to create a barrier to mating so great, that they would be incapable of crossing it a very long time would be the answer. And we can tell that because apparently Neanderthals and modern humans did, mate. But here's the thing. Here's the thing that we're all missing in this sort of question. The answer is staring us in the face. How long does it take for a language to become uninterpretable? by a descendant language, right. And so in some sense, to people who cannot communicate with each other, because they do not share a language can produce an offspring, but they are very unlikely to by any honorable route. And so that is a kind of speciation mechanism, but it is below the species level is at the population

**Heather** 02:29

level. Yeah, no, that's great. And I've just finished that by pointing out how many such divisions there are among the descendants of the orange Ian's that a Navajo and Candiotti person in the Andes. And about Debian, from the coast of the west coast of South America, or one of the people in the southern tip of their territory, Tierra del Fuego would have almost nothing in common. They were dealing with different problems in different places. And they've been separated by enough time and also distance that they would have shared a little language, if any. And this this, this is that. So there was change over time. And these species boundaries that we put on things, you know that the usual definition of species that people have in their heads, is one of can they mate, right? If If two individuals can get together and produce viable offspring, this is the so called biological species concept, which of course raises all sorts of questions about what are the kinds of species concepts you might have? And unfortunately, we could spend a whole lot of time talking about all the different species concepts once you get into it. In evolutionary biology, you see, that species is a necessary distinction to use to talk about differences between populations. But at best, the boundaries between species are always fuzzy. At at temporal borders, and sometimes at spatial ones.

**Bret** 04:01

Yeah, at first they are but in human beings, if you're in capable of conveying the concept, Hey, how about dinner in a cave painting? Maybe you're not going to get anywhere? So it's effectively a meeting boundary? You've got that look in your eye. Alright, I'm going to pretend you don't.

**Heather** 04:17

Next question is from Eco, over evolutionary time, does the Y chromosome lose most of its original genes and increase its non recombining region? What is the benefit? are male mutations more risky? As in a winner take all or get wiped from the gene pool? Before I know you wanted to answer this, let's just clarify that the Y chromosome is is present in male mammals, but that that that particular mode of sex determination is a mammal specific thing. So this answer may or may not what oh Cat, cat antics, may or may not obtain across a wider swath of evolutionary history.

**Bret** 05:02

Yep. All right. So what I wanted to say in response to this one is, if you think about chromosomes and the information they carry most of your chromosomes, all the autosomes spend an equal amount of time in male form and female form, they find out in the zygote, what they're going to be. And then they are that thing, they're trapped for that period of time and male or female form, and they act accordingly. the Y chromosome is quite different. The Y chromosome is the only one in which the genes know whether they came from mom or dad. And that creates a hazard with the Y chromosome, which is that its genes can play a different game, its genes can play against the maternal chromosomes, and in their own interest. So for example, a gene that found itself on the Y chromosome and in a zygote would know that it came from dad, and therefore might take more resources from mom during pregnancy, especially in a species or population in which meeting was not monogamous, because they would know that the siblings that they would be depriving of resource by extracting more than the mother was tempted to give would not be close relatives, they'd be one quarter siblings rather than one half siblings. So in effect, the best argument that I'm aware of is that the Y chromosome is devoid of most coding genes, because it is untrustworthy. And therefore, it is effectively been shut down. So here's the punchline,

**Heather** 06:43

I thought that the Y chromosome being untrustworthy was a pretty good punchline already,

**Bret** 06:47

it gets better. Okay. If patriarchy were a real thing, it would be on the Y chromosome, and therefore it has been shut down because the rest of the genome understands it has an interest in preventing that kind of competition from breaking out. Now, I want to be very careful here. I do not believe that patriarchal phenomena are unknown or impossible. It is patriarchy, which I regard as a myth. And so noting that biology long before anybody was discussing anything, had taken up arms against the possibility of patriarchy, and had left the rest of the genes in a a rawlsian veil of ignorance situation where genes don't make rules that favor males over females, because half the time they'll be in a female form, and therefore it wouldn't make any sense to do it. That's the situation we find ourselves in for the most part. And so it doesn't mean, history hasn't been very unfair to females, it has in some ways, it has been unfair to males. In some other ways, it is time for us to renegotiate this deal between the sexes, but understanding how deep the biology of this conflict and how Rick, the solutions to it have been over the course of hundreds of millions of years, is well worth our consideration in navigating this did not start with people.

**Heather** 08:11

Yeah. So I feel like both of these should, should warrant much longer conversations. Indeed, I want to take slight issue with two things that you said I'm distracted by the fact that there's a cat behind me in the blinds.

**Bret** 08:24

You're going to take issue with what I said even though you promised to obey I did not know you didn't know.

**Heather** 08:33

I agree with you that especially the way that the people who I like to call the pseudo feminists are suggesting that patriarchy is explaining a lot of the world is is not right. But from in terms of the word as it is used by anthropologists, where we have these sort of three different endings that are often appended to matriarch Patria to decide to delineate whether or not it tends to be the female line or the male line that has in the case of locality, Metro locality versus Petra locality. Do children when they married tend to go and live with their mother's family or with with the bride's family or with the groom's family. I'm going to forget one oh linearity, Patrick Petro linearity, and Michel inequality. How do how do resources tend to flow but especially names and so obviously, you know, I didn't take your name, but in general, we tend to have a patron lineal society. And then archy refers just a power. So who tends to end up holding the reins of power, and it almost always is men. Right? And there are a lot there are a lot of understandable evolutionary reasons for that. So I would say you know, we tend to have a lot more variation in whether you have Metro local, Metro, local or petrol local societies, matrilineal patrilineal societies but with regard to sort of who ends up doing the work of the world outside of the home and therefore has the power, it does tend to be I'm sure and so at that level at this sort of anthropological definitional level of what the term means, we have, we tend to have patriarchal structures rather than matriarchal structures. But that does not mean that, you know, we're living in a top down, men have made all the rules in order to enslave women's sort of world, which is the sort of cartoon version that we hear from the third wave and beyond, feminists

**Bret** 10:22

wouldn't make sense for men to do it. And they don't do it, which doesn't mean that men haven't come up with some perfectly ridiculous solutions to problems, unacceptable stuff. But But consider the possibility that patriarchy as it is wheeled wielded in common parlance is a myth that obscures a much more interesting and nuanced set of questions about the predicament that men and women find themselves in today.

**Heather** 10:47

So the second thing that I want to take slight issue with is the idea that only the Y chromosome is capable of knowing where it's from. And I think I mean, you, you know, this, but the way that you said it, it sounded like there was no ability for genes to track their effectively their heritage. And we know you have this concept of genomic imprinting, which emerged from the David Haig lab, in the late 90s, I guess, but when we were in graduate school a little bit before, suggests that actually, particular genes can track who they're who they're from. And actually, you know, paternal genes are more likely to produce bigger babies, the stealing, you're stealing, taking more of mother's resource for this baby, especially in species or in populations, where you don't have pair bonds, and where the father of this baby may not be the father of the next baby by this, this a mother. So the Y chromosome is certainly only ever in, in males, in mammals. But there are other mechanisms by which genes can effectively keep track of who they came from, although any individual gene could have probably spent equal time in men and women in its history.

**Bret** 11:58

So let me fix what I said. It is true that they are not the only genes that can, but are, they are the only dreams in which we expect the sequence itself to be modified by the reliable fact of having come from the Father. And so for those of you who are finding this all mysterious, the amazing thing about the Y chromosome is that it has one really important gene on it. It's the SRY gene, or the TDL gene, testes determining locus, this is the thing that tells the rest of the genome Hey, guess what, you're a male, go down the male pathway. And so it affects what the rest of the the genome transcribes. It affects everything else. But it's basically a signal that says, go down this pathway in the absence of that condition. Yep, in the absence of that signal, you go down the other pathway, which is the default pathway, which is female. And so it's not that there are no other sequences on it, but there's precious little on the Y chromosome. And the important thing is this, the single locus, and so it does appear like a kind of a sequence desert, right? Unlike the rest of the genome, which is rich with information of all kinds, much of which we don't yet understand. This one thing is a gene in a sea of not very interesting stuff. And that's, that is in and of itself a fascinating and conspicuous fact.

**Heather** 13:24

Yep. All right, next question. Is the evolutionary process searching for something pertaining to divergent cognition, such as high functioning autism or Asperger's? Or not stem analysis methods intrinsically inadequate to engage with cognition based analysis instead? versus race or gender? I don't totally get it neoman a hard time parsing this one?

**Bret** 13:51

I think there's some pieces I spot in there. So you want to go with that? Yeah. So I don't know whether, you know, what we call high functioning autism or Asperger's syndrome is really a pathological state at all. Right? It's possible that it's some sort of built in low frequency useful at a lineage level phenomenon. And then maybe the connection to debilitating autism, or severely debilitating Autism is not what it seems because we've done a poor job of figuring out what the etiology is, and therefore

**Heather** 14:27

and that's, that's actually out there live among many psychologists, the idea that this is not actually a spectrum, but really, at least two perhaps multiple distinct things. Yeah.

**Bret** 14:39

And so anyway, I guess I would say there's a caution which is, especially in places like psychology, it's not psychologies fault initially, but it is much easier to be descriptive in the realm of something like the mind and its functioning than it is to be mechanistic, because minds differ a lot even more They work functionally in a similar way. And so anyway, we end up defining syndromes, and then we discover that our definitions create some sort of an in compatibility when we bring them to a logical extreme. And so anyway, beware that when somebody says something like autism, they're not saying something specific like RNA, right? They're saying something that might be at the level of a syndrome. And a syndrome might be triggered by multiple things, and therefore have different meanings. And anyway, you may be looking at something that has a rare adaptive form that we call Asperger's, and then a pathological form that we call autism. And it's not a spectrum at all, but it has some sort of overlap.

**Heather** 15:40

Yeah, and I guess, the more I look at the first part of this question, the evolutionary process is not searching for divergent cognition, per se. But as we have, as we have said, elsewhere, and else times. Elsewhere, I guess. The humans are both highly specialized and highly generalist. And we managed to be both in part by being so social by living in such tight knit groups. And so having one or a few members of a group, having what you're calling here, divergent cognition, in one of a variety of ways, as I we've talked about before, you know, it might be might be dyslexia, or left handedness or for being on the on the autism spectrum, or any number of things, may well allow for a greater problem solving and may actually be a population's road into the shamanistic when, if the rest of the population is is quite embedded in the orthodoxy on the sacred.

**Bret** 16:39

So I can translate that into our usual language. The evolutionary process builds mechanisms that search. So we've called that explore modes. And could something like autism, or left handedness or collective consciousness, all of these things play some role? And so how these things interface is a little hard to say, but but somewhere in the neighborhood of your question seems to be a potentially, right concept. Yep.

**Heather** 17:13

Well, finding a cure for cancer proved to be impossible. Does cancer somehow fundamentally serve life? Thanks for everything?

**Bret** 17:21

No, it doesn't serve life. Yes, it will be impossible to cure, it does not mean that it will be impossible to render it manageable. So in my paper on telomeres, I believe it made the final final version of the paper, we proposed the possibility of extending lifespans by elongating telomeres, which would only be tolerable in the case that you were very good at managing tumors so early, that it was a trivial matter to deal with them. So imagine, for example, and there's a reason you can't do this yet and shouldn't even try yet. But imagine that you went for regular body scans that found a reliable signature of something that had crossed over into tumourigenesis. And that there was a mechanism for dealing with those things when they were tiny, and your scans were regular enough that nothing ever got beyond tiny. Well, it might be that you could then deal with all those cancers in a way that didn't matter to you. And you could get some extra youth, because basically, you'd borrowed from this new capacity. You wouldn't want to do anything when you want to try anything like this right now. Because in all probability, proto tumors, which is a term I tried to coin in that paper, which are things that are not tumors, but they are basically one mutation shy, these are round growths that probably exists in almost every tissue in the body, on the surface of our skin, they would be moles, they would be colorful, in your liver, you'd never know they were there unless somebody went in with a microscope and look, right. But these things are likely to be so common, that if you got to scan and you look for all sorts of growths that were out of place, you would probably find so many of them that you'd be overwhelmed. And even if you set some threshold where you could ignore most of the ones that were never going to harm you, you would still be constantly facing false positives, where you think you had some cancer that needed to be dealt with. And in fact, what you had was some growth that would never bother, you would never cause a pathology. So we're not anywhere near this. But is it conceivable that in the future, body scans could be good enough and techniques that using the word surgically, metaphorically here that is surgically dealt with only that tissue would question and didn't cause a larger wound could be so good, that we could extend human lifespan this way? Yeah, that's conceivable.

**Heather** 19:58

Next question. I'm interested in pursuing research and mathematical modeling of biological systems. I was just wondering if you have anything more to say on this? Are there any warnings you'd give me any traps I might easily fall into? Oh, boy,

**Bret** 20:13

I mean, I got to

**Heather** 20:13

you got to I got to I mean, I, the thing that comes up for me first is that the few modelers that I have known at all, have not have not been focused on hypothesis. And that I don't I didn't know them before they were modeler, so I don't know if it was drummed out of them by by being a modeler, or if they went into it sort of with a data driven approach, rather than a hypothesis driven approach. And there was nothing inherently about modeling that should that can't be hypothesis driven, but that it looks at the just anecdotally, to me, like those being hypothesis driven and being a modeler aren't living particularly well, side by side that much the detriment of the accuracy of the models that we're using. So, you know, keep hypothesis front and center in your mind.

**Bret** 21:10

Yeah. predictably enough going to have a similar message, which is, models can be made to mirror behaviors that they do not actually tell us anything about. If you include enough parameters in the model, you can get them to spit out behaviors that look like just about any natural thing you would find. So the utility of models is in generating hypotheses that then require a test. In very simple cases, you can use a model to test certain ideas. But as you're dealing with something complex, like biology tends to be, you want to take a model and use it for its highest and best use, which is the generation of possibilities which you then test in nature. And so what Heather is responding to is that the tendency is to use models as a cheaper way of accessing nature as if they were true, and the assumptions just aren't supported. So beware of the problem of making models that mirror the behavior for the wrong reasons, not because they are internally not like the system in question. I should also say, be aware that model means really two different things. You say mathematical model, I take that to mean computer model. I generate models, and I think they're useful. But the point is, the model is a description of the way a system might work. And then the hypotheses get tested in nature. And if they, if they give you predictions that actually turn out to be manifest in nature, especially if those predictions are surprising, they reflect well on the whole model. So my model of telomere senescence and cancer was bolstered by the demonstration by human and grider. That lab mouse telomeres were anomalous, and that wild mice had short telomeres. That prediction does have lots of interesting implications. But to me, the most important was that it reflected well on the larger model, which said something about life history, strategies in creatures like us. So two different kinds of models.

**Heather** 23:20

What do you think is the most accurate assessment of COVID-19 mortality rates? As estimates vary? I don't know. You know, I, I mentioned that I think, sort of off the cuff, I said, that it appears to have a case fatality rate, which mortality rate is a bit of a looser term, but a case fatality rate being just a what percentage of those infected die, something like four to five times that of flu, it could be 10 times, I think there's, I don't think we will find that it has been during this time during the time of the pandemic, anything closer to that of the flu, it may, it may come to that, you know, it may within a year from now, if it's still here, if it doesn't disappear, which some coronaviruses do. It may end up equilibrating at something close to the CFR for flu, but I think it's going to be something right, will have been something right now, around something like a half a percent. But I honestly don't put a ton of competence in that estimate.

**Bret** 24:24

Yeah. And again, I'm gonna dodge the question and say, I am suspicious that different strains may differ and that may be throwing us different locales may differ that change over time will cause the number to shift. And even if change over time did not cause the number to shift, that our understanding of the symptoms and their meaning will cause our treatment of it to get better. So for example, let's say not saying this is true, not a doctor don't know. But if it was true, that people with severe respiratory scars code to infection tend to present as somebody in need of a ventilator, but the ventilator makes matters worse, and we learn not to put people on them, you would expect the case fatality rate to go down as a result of our painfully earned knowledge. And anyway, no doubt, there are dozens of ways in which we are learning how to treat people better than we were in the early phases of this would drive the CFR down. So

**Heather** 25:28

yeah, when there's also this, so this is something we've talked about, and maybe deserves more time and the regular part of a future episode, although at some point, we're going to start veering away from COVID-19. And talking more about other things. This virus seems at least capable of and quite likely, is mutating very, very quickly. It is spread fast into many different domains across many different types of environments. And we know you know, the genome has been mapped in a number of strains, and we know it's changing fast. That, that, but that right next to the fact that we keep hearing that both the tests for active infection, the antigen test and tests for passive infection, the antibody tests are wildly variable in their accuracy. That you know, you don't you can't just say, Okay, this one has a 2% false positive or 1%, false negative, these tests seem to be wildly variable. So what might that be about? Why is this white? Like, it's one thing to try to find a vaccine? And we've talked before about how difficult it may be and how we may never get one? But you know, hopefully we do. But why are the tests so bad? The tests, as we've talked about, right, may be bad, because using a test developed for one strain will not work on a different strain. If the evolution if the rate of evolution is so fast, and the piece of the you know, whatever it is that the test is looking at, it doesn't happen to be in the new strain, we may get, we may be getting, you wouldn't get false positives this way, but you will get a whole lot of false negatives. So if you had and, and likely it would be mostly the serology tests, the tests for antibody testing past infection. And that would actually, if that were true, that would mean that the background rate of infection across many parts of the world was much higher than it appears to be. And that would also, you know, once the denominator goes up, that means the case fatality rate goes down. But that also mean it just has huge epidemiological implications. If it's true, if a whole bunch of people who felt like they probably were sick, actually were sick, even though the tests are coming back negative, and a whole bunch of people, therefore, who didn't think they were sick, probably were as well. But perhaps the tests they're using were made in one part of the world, one part of the country that had had a different strain than the one that was in the part of the world they're living in. So this is a possibility that I haven't heard anywhere else except in our house. And it's, it makes this question, you know, what's the most accurate assessment of COVID-19 mortality rates even harder to get close to? It does,

**Bret** 28:00

and it also suggests yet again, that we were at least in the right neighborhood, when we're talking about the Theodore Roosevelt, the aircraft carrier that had an outbreak and the lost opportunity of a population of exactly known dimension that could have been followed in order to figure out how these patterns actually work. So I guess the point would be, look, it's still not too late to start carefully tracking some populations so well, that you could establish who had had an infection, you know, frankly, by, you know, viral shedding or whatever. And then we could test the hypothesis that the tests are, you know, inaccurate in an inconsistent way based on what strain you had versus what strain the test was built for. So anyway, still a good idea. And if not, for this pandemic, then for the next one.

**Heather** 28:59

Next question. The YouTube video mathematical challenges to Darwin's theory of evolution is a scholarly discussion of the mathematical mathematical impossibility of Darwin's theory. Is this a reasonable challenge? The theory? Is this a new idea? You're nodding as if you know

**Bret** 29:12

the video I do. I looked it up to make sure it was the video I was thinking. Oh, when you saw the question, yeah, it's David Garner, David berlinski and Stephen Meyer. Oh, it's

**Heather** 29:22

that one? Yeah, it's that one.

**Bret** 29:23

Okay. So all right, I'm now going to get in trouble with everybody. So hopefully you'll stick with me you've committed to do that. To view it was nice. No one Yeah, but

**Heather** 29:33

I think okay, I can tell people to

**Bret** 29:35

they will as well and the,

**Heather** 29:36

the the pet side of the animals. Yeah. Well, they don't know what you're talking about. So this won't change anything for them. Now, that's

**Bret** 29:43

true. In any case, I I know those three guys, and I must say quite like them. There are challenges to say who it is against David Gartner triggered a wave of controversy by Ariza computer Math guy. And he basically said that he had come to the point that he didn't believe that Darwinism was a accurate model. And, of course, Stephen Meyer of the discovery Institute has long been searching for evidence that Darwinism is inadequate to this, to explain life as we know it. And David berlinski has yet a third position. None of them have the same position, which is interesting.

**Heather** 30:25

But they're all skeptical of the standard issue Darwinian framework. Yeah.

**Bret** 30:30

And, you know, when I met these guys, I told them, that I thought there was something to the challenges that were being leveled, not all of them. But some of the challenges that were being leveled had content to them, but that the solution actually was a deeper kind of Darwinism that basically Darwin had been right. Darwin was, of course, not very specific, because he couldn't be in the absence of knowledge of how genes work. But I, you know, I flat out told them, I said, Look, this is your Waterloo, are you ready for it? And you know, I haven't persuaded them. They haven't persuaded me. But the thing that I find so troubling is that the field of legitimate evolutionary biologists treats all of this as if it is not offered in good faith. I don't believe this is the case in any of these. In the case of any of these three people, they are all skeptical for their own reasons. I believe they are in the end wrong, but it doesn't mean that every challenge is incorrect. And, you know, challenges like, you know, essentially, is there enough time, given the mechanisms that are presented in order for the for adaptation to have discovered the various things that we credit to it, if that is the if the mechanisms involved are the ones that we describe in the textbook, I think this is actually a fair challenge. And to the extent that the field discovers that the mechanisms we already have in discussion are perfectly adequate, the field will become stronger for having demonstrated that, and to the extent that we find out that actually there is something there is a gap between what we claim is being explained and the mechanism that we have set explained it that points directly to another mechanism. Now my point is, that mechanism is Darwinian, it's a different Darwinian mechanism. Darwin didn't say, you know, DNA to protein was the only Darwinian mechanism, he didn't have any position on it, because he didn't know about DNA. So my point would be, there is a missing mechanism, it does render the story that we tell about how Darwinism works inadequate. And that in effect, the solution involves what we have called explorer modes that basically, over time, the root Darwinism discovers more and more effective ways of exploring design space. And so it finds solutions faster than it would if it was doing this totally haphazard thing where, you know, I mean, you've all heard the story, right? There are lots of mutations, most of them are bad every so often one of them is good, those good ones often go extinct anyway, they Yes, they get accumulated the accumulation ultimately produces things like wings and eyes and all of that. And my point would be no, Darwinism produces those things. But it isn't that simple random mutation mechanism. It's other ways that Darwinism has given rise to exploration of design space. And I think, frankly, as much as some of the critiques offered by Gartner and, and berlinski and Myers are, I think, dead ends and not accurate. No, I'm not. I'm not concerned about the Cambrian explosion, for example. But to the extent that some of their critiques actually really do stand up to scrutiny, the field should take them seriously. These are decent people, and they're offering

**Heather** 34:02

the critiques of people and very smart people who are not who are not naive about the level of complexity that they're thinking about.

**Bret** 34:08

Yes, well, I mean, look, two of them are not biologists, right. Some of their critiques actually are fairly easily dealt with. One of them is a biologist and a very good one right now does have a take he's, he has a particular thought, which is that design is the explanation and I think he will turn out to be dead wrong, but but nonetheless, the quality of the evidence that he brings to bear is higher than you would expect.

**Heather** 34:38

Yeah, so I'd like to get through at least the $20 questions here so we have a lot more let's do a little a little fast and then go to the next.

**Heather** 34:50

Well, I just lost her I was up Can you tell me how seemingly complex animal instincts evolved or inherited thanks? Not quickly. I mean, I think I think you kind of just got there actually with the last question. I mean,

**Bret** 35:06

it's like everything else. And you know, darkness does a good job with, he has a beautiful job, in fact, on the eye, and how you get to an eye with the challenge that we've all heard, you know, if half an AI is of no value, how could you possibly get to an AI? And it turns out half an AI is of great value. And so being able to spot how small differences in capacity could accumulate, with no places where there is a big jump downward in utility. That's the basic answer. And so, you know, a crude ability to deploy some program in the world that you might call an instinct that has some tendency to adjust the probability of finding food or whatever in your favor, that gets refined over time into something that's almost impossible to imagine. But if you saw the steps, you'd get it.

**Heather** 35:57

Yeah. And I think there's something if I don't know who the questioner is, I don't know if they've used the language here with with intentional precision. And you know, instinct, instinct is one of these words that often animal behaviorists don't use any more, because there's very little that is just completely programmed in, at the level of behaviors, but complex animal instincts might actually be pointing to something that is behaviorally simple, but actually requires a whole interplay of anatomical, physiological, and or chronological, perhaps developmental things to come together. And so you know, how do you get a simple and perhaps binary outcome with a whole lot of complexity behind it? And you know, it's going to be the same kind of answer, but it is harder, it is harder to imagine your way there. And you know, as as again, Dawkins has said, failure of imagination is not an argument. But it is, you know, the eye argument that he makes, so elegantly the Dawkins makes so elegantly, is an easier one to to grok, right, because any ability to sense the difference between light and dark is better than no ability at all. Even if that first photo receptor, if any of us who are fully who have full vision, were to go back to that state, it would feel like a terrible loss. But from total darkness, it's a great advance. So when you have a system that looks like you pull out a single thing, and you've got a Jenga tower falling, it's harder to imagine how it worked. But, but with most of the systems, we can't actually put it together. And that's, in fact, a lot of what a lot of what comparative anatomists and development biologists do is figure out what those what those are. Okay, next question. Love the podcast. Thank you both for what you do. Question when you get on a plane, assuming you're a healthy, say, 30 is adult if your essential job required travel, assume driving is not an option. Any travel advice? Yeah. It's a good question. I've seen some horror stories from planes have just packed and, and you know, for sure, wear a mask, and then do everything you can to, you know, create your own personal cocoon of airspace. But beyond that, you know, we were flying a fair bit in the last couple of years and haven't Of course, at all, I guess, since I got back from LA is the last time either of us flew in mid February, no, actually. So a good three months, which is a long time for us, and I miss travel, and do not miss. I dread the idea of being on a flight. And yet, it is necessary for many people. And in some ways it might be safer than driving as a driving isn't an option, but having to go you're having to go on land through a lot of places that may have their own little pockets of epidemics, having to you know, pump gas and get food and such, may put you at that high risk. And you know, the shorter the flight, the safer. Probably nothing to add here.

**Bret** 39:15

That's certainly going to be true, how much safer is unclear? I mean, the answer is, you're probably safe if you're not in the path, you know, and the way these things move around plans is not straightforward. But if you're not in the path of somebody who's sick, then you're probably safer. And but here's what I would say, I'm actually facing this question because there's a flight that I'm supposed to take, it's not real soon, but soon enough, a few weeks. And, you know, I'm trying to figure out whether or not I should cancel it or not. And, you know, it's something I've already committed to and it's the one thing that remained on the calendar when everybody canceled everything else. And I thought about the question of whether in this case, I would break out One of the respirators that we have for no reason for carpentry or for, you know, spraying solvents or something like that. So these things are much more industrial strength, much less comfortable in the band. And I gotta tell you, but the problem, the model for the infection, one I'm running around with in my head at the moment, is there's some vessel that when you encounter somebody sick begins to fail, and if it gets above some threshold, then you're likely to get sick. If you keep it below that threshold, you are unlikely to get sick, nothing is impossible, but unlikely. So if you have a two minute interaction with somebody, it's very, very unlikely you will reach that threshold even if they're sick. Right. But if you were sitting next to somebody who's sick, the chances that you'll get through, you know, an hour flight and not reach that top level is pretty low with a respirator prevent you from getting to that level, I think so I

**Heather** 41:02

would want to come in it also depends on how many ways it can spread. So the the emerging medical consensus, which, who knows if it's right, but the emerging medical consensus suggests that airborne is clearly the way that this spreads most. And the aerosols, probably, and fomites, the stuff on surfaces, poses actually very, very little risk, which if true, you know means that retail can open up to things like that, and it's sitting next to someone, if you and they are both masked, is actually pretty safe. Yep. Well, if you and they are both masked, yes, but I would still say in a flight and you know, even an hour flight, you could get stuck on the tarmac for an extra hour. And so, you know,

**Bret** 41:46

I trust my bandana, if I'm in a position to limit my interaction with anybody I don't know. So if I'm, you know, blazing through a store to you know, to get groceries or whatever, I'm in a lot of control over whether I spent a lot of time with one person and an airplane, you lose that and so I might go the extra step and and use a respirator though I'm not happy about that as a choice, I do think it would work.

**Heather** 42:15

A quote from my lecturer, quote, the role of an educator is to teach children to knock off the arm of social injustice from within the body of the system. Wow. And quote, any tips for aspiring teachers who don't want our society to hemorrhage out? Man, the schools of education have been captured. And that means that they are literally coming for our children. How is it that we can get you Elizabeth and other aspiring teachers to stay in the system and actually teach children? The right thing? I think, you know, first you have to get through school. And that probably does require some, some fence some some lies about what you actually believe in, that's awful. That's not education is the opposite of education. But once you have children, you don't do that. You teach them to experience their own bodies and the physical world and learn from what they experience and believe their eyes before they believe what someone told them or what they read in a book or on the internet. And, you know, it depends, of course, what level of educator you're looking to be if it's five year olds, 10 year olds, 15 year olds, 20 year olds, 15 year olds, but increasingly, it's tough within the K 12 system, to do even what, you know, aspiring teachers who really have a drive to educate what to do, because of the basically the the authoritarian stuff coming from from on high, that, you know, come in nice sounding boxes like no child left behind and such, but are actually ways to enforce orthodoxy on children and, and believe them of passion. That was a very promising answer.

**Bret** 44:06

I would just say, there is no good answer. I don't know how you would get through such a program. I certainly wouldn't. On the other hand, what's certain to happen is the more absurd the claims become and the more ubiquitous they become in school as a result of the fact that the schools of ad are are selling people this nonsense. The fact is, people will have no choice but to pull their children out of those schools and then the schools will collapse. And so I don't look forward to that period. It could be the end of us because it might have a very destructive effect on our body politic but but I don't think we're very close to the end of the of the story of this pollution because it's gotten so abhorrent that

**Heather** 44:56

people will not tolerate it now and you actually mentioned one of Toby 14 year old teachers in the last live stream who created these his both his English and history teacher and he created a whole section on dystopias and and it's just doing a fantastic job of you know, he's not pushing anything down anyone's throat but he's exposing these children to so many different forms of, of literature and film and music that basically teach Think for yourself without setting up these. Of course, it doesn't work when you say, Okay, I'm going to slowly, early on. Many thought that Coronavirus had already arrived, including myself a virus did the rounds here in Shetland, late late January, which seemed to fit. Apparently it was h1. Anyone? Have you seen any information regarding concurrent viruses? I haven't. That's and that's fascinating. That's intriguing. Yep. I don't have anything more to say about our it's probably worth looking into. Yeah. Oh, the next two before we skip to the next one to just comment. Someone wants us to look at an email sent last month, Zach, if you would just highlight that. So we remember to do it. It's, I think it was maybe the last one in the last live stream. I'm wondering if you might have a chance to read an email, Jason Pollack. And then keep this information flow running, please. Peter says we will. So Zachary if I go here. Yep, I see it. All right. Our cats are getting hungry. We're running low

**Bret** 46:33

on hope they don't attempt to knock off the unjust limbs that are failing to feed them.

**Heather** 46:40

They meet you on each other, but I think social injustice is not high on their list. All right.

**Bret** 46:44

Yeah. When they're in capitals, I think Yeah.

**Heather** 46:48

flus next So first question from the current live stream from Gumby, the green fluids infection fatality rate is only point 03 percent. Okay, so I the popular point. 1%. figure is for symptomatic cases, which is clearly what I was referring to earlier. But 77% of flu cases are asymptomatic. Thus I say COVID is 10 to 30 times deadlier. What's your current estimate of COVID? IFR? That's I wonder if I think you probably asked this before we answered that question in the last one because I think I was certainly working with the popular point 1% figure for flus IFR, but given that 77% of flu cases are asymptomatic, we understand flu a lot better than we understand COVID-19 wouldn't surprise me at all if 77% or there abouts of COVID-19 cases are asymptomatic. So so really true about flu? I don't know I'm taking I'm taking this at face value of the question. Fact is, we don't know. And the number of cases that are asymptomatic and possibly not testing positive beans that our data are, are just lacking. Yeah, so it could well be that COVID is 10 to 30 times deadlier. I don't I don't think that that is in any way outside of the realm of possibility.

**Bret** 48:09

If you have a reference on the asymptomatic flu being that high, would you send it to support at Bret Weinstein? dotnet?

**Heather** 48:18

Thanks. If damage causes aging, why does exercise slow aging down? does it increase telomerase and less lengthen telomeres?

**Bret** 48:27

Really good question. In fact, somebody asked me this over email today. Let's just say there are several things in play one. First of all, exercise is not specific enough. And we have there are several tissues that don't behave in a normal way because their cellular structure is not standard. So skeletal muscle being multinucleate. And strength training, being a matter of increased fiber density or fiber number rather than increased cell number means that you can, in some sense, build muscle without adding cells, therefore not degrade your your quantity of remaining Tila.

**Heather** 49:14

There's also I guess, to dendritic and synaptic connections of neurons, right? And yes, in fact, that was exactly what I

**Bret** 49:21

answered this person over email was that the brain is also similar in the sense that exercising the brain is not a matter of cellular growth, it's a matter of dendritic growth. And so that also doesn't predict degradation through use quite the opposite.

**Heather** 49:39

But you do see damage from Excel from I don't know what the numbers are, but something like going to, you know, 90% and beyond of what you're capable of doing, both at the muscular and cardiovascular levels, I think, actually puts you at least for a short term at greater risk of getting any viruses or bacteria that you may be be exposed to, and probably also does cause faster agent of those tissues that were damaged from that particular kind of exercise. So

**Bret** 50:09

honest to goodness, cellular damage does have this effect, some tissues involved don't regenerate very well. So cartilage, for example, does not regenerate. And you can give yourself arthritis by, for example, running on hard surfaces, this sort of thing. So what I would say is it's a tissue by tissue analysis. And then the final complexity is that exercise obviously does some things for you that actually reduce wear, even if the exercise itself causes where if it brings your weight down, and the amount of wear and tear you're doing for each step is less. So it's a complex phenomenon. And what you need to do is figure out what the net of all of these things are, and also figure out how to play the game. Right? So to the extent that, you know, for example, biking has the cardiovascular benefits of running but it doesn't do the damage to your joints, it may be something worth considering

**Heather** 51:02

in swimming even more so. Right, right. Hi, math major here, after you prove a conjecture becomes a theorem, not an axiom. axiom is something you can't prove and assume correct foundations of mass. Otherwise, absolutely correct analogy, love from Russia. PS allow an open discussion certainly went. Yep.

**Bret** 51:22

I love this. Now there is some ambiguity, because I mean, basically these things don't map perfectly. This

**Heather** 51:28

is a reference to our episode 1516, it would have been

**Bret** 51:31

right. And so the I think the point that this this person is making is that an axiom is presumed true, which is also the case for a theory, right? presumed true. In the case of axiom, the part that I think I got wrong is that an axiom could turn out to be false, right? And so anyway, several people did point out this nuance, the upshot wasn't entirely clear, but let's just say the mapping is not perfect. I think I suggested that it was closer than it actually is. But nonetheless, the parallel is there. The question is really one of terminology. And anyway, I have to say, I'm pretty excited that a large number of people seem to have taken the the question of these terms and their meaning and their philosophical interaction very seriously, which means the message made it through. So anyway, that was the point and let's keep discussing it because we might be close to making a higher quality interaction.

**Heather** 52:32

Excellent. Sorry, I was distracted, there was a cat behind you. Climbing the Darkhorse. Echo says many Thanks for answering the FF evergreen episode is very beautiful. Thank you. is a two part, Joe actually said that Alex Jones video on him moving to Spotify was not true. He's doing it because he wants to try to model where the platform is a partner. censorship was not actually part of the move. It was in the very same podcast with pakman Keep up the good work. I haven't seen any of it. I don't know.

**Bret** 53:05

Oh my god. That's a That's incredible. All right. Well, first of all, my apologies to you, Joe for taking Alex's video at face value, but

**Heather** 53:18

it's almost hardly ever good friends, right?

**Bret** 53:21

Well, I didn't know if they were good friends, but it was almost hard to imagine that that Alex Jones would have said something so clearly false because it couldn't possibly result in anything other than Joe who has the biggest megaphone on earth saying that's not true. So you know, why would you do it? Why would he do it? But But anyway, I call it wrong. So anyway, I do hope that Joe's move to Spotify has a positive impact on that eliminates the senatorial bias but who knows if that was part of his thinking.

**Heather** 54:00

Can wearing masks prevent the spread of strains that have mild or no symptoms? This is an excellent question and I have I have wondered it you know, given that people who are let's just make it clean and say who are asymptomatic are not coughing, air droplets of people. At the very least, they need to be in closer proximity probably for longer because speaking is going to eject fewer than coughing or sneezing well, that said you know, something like like singing or yelling will produce a lot of air droplets and people do you know, all of us sometimes find ourselves talking like and can can watch something come out of our mouth much to our embarrassment, right. So, yes, but will they will masks prevent as many infections in in a person who is asymptomatic who was wearing them as opposed to a person who is symptomatic who is wearing them? Probably not, but Certainly will prevent more, it will prevent more infections then not wearing it at all.

**Bret** 55:05

Yeah, I guess I'm not really sure why one would expect it not to work.

**Heather** 55:11

I mean, the fact is that the question isn't binary, though it's not about maybe I just can't read it. Can Can wearing masks prevent? Well, yeah, I guess you could read it that way. I read it as, as you know, will they do they stand some chance of being effective. And I, you know, given that earliest, the main symptom that people talk about in in sort of the classic COVID-19, if there can be such a thing for a disease it's been around for less than a year is the extreme and unending coughing, and coughing is going to just spray droplets. So if you don't have symptoms, you're going to be spraying droplets at speed less so

**Bret** 55:51

then, right? But the point is, the mask takes care of some large fraction of droplets. So to the extent that asymptomatic people are spreading the disease to people who haven't been exposed yet, it seems to me like the mask has the same positive effect, it will still filter out some fraction of those particles and result in the exposure being that much less intense, and therefore that much less likely to cause infection.

**Heather** 56:19

So if I can try to translate this, I think you're saying that say that I'm just gonna put fake numbers on this, say someone who's actively coughing, and not wearing a mask would infect 10 people. And by wearing a mask they can produce let's make it easier can affect 100 people. And by by wearing a mask, we can reduce that to 10. And then thus, it's a reduction of 90% of the infection. A person who's asymptomatic but has the virus might only affect 10 people because they're not spreading as much and wearing a mask, which is expected to have exactly the same fractional effect. So in that case, the person who would be infecting 10 people is now only infecting one. And the person who would be infecting 10 people is only affecting 10. But there's still there's just as much gain in in Canton loss. There's just as much decrease in infection transmission. But you just start out at probably very different places.

**Bret** 57:18

All that assumes droplet sizes the same for the symptomatic and asymptomatic but droplet numbers, right. But we don't know

**Heather** 57:25

that there's an all else being equal. Yeah, assumption there, that may well not be true. Okay, how much do you trust the bioinformatics people in regards to figuring out what saris curve two strains there are? Do you trust my Python or our program says so? Should we trust the implicit models? such as both a general and a particular question? Yeah, I it's this one here. Certainly, I don't trust the attitude that my Python or our program says so. In fact, this is this is a big beef that I have with a lot of the way that modern, that the analysis part of modern science is done, that even very careful scientists, who are hypothesis driven, and went to great lengths to do exactly the right experiment in order to address to distinguish hypotheses and collected data very carefully, in in a very controlled way, are often very willing to throw those data into some effectively, big complex black box of a syscall analysis program, and have something pop out the other side, I'm going to pop what pops out is something I like they go, Oh, yay, this is wonderful. And maybe don't question whether or not they met the assumptions of the test whether or not they slid something wrong. It's been a long time since I've used bar at this point. And I was never very, very good with it. But it's, it's a, it's a complex program, as all, you know, as as sasses, as SPSS is like, all of the stats programs are, and you can do too much without really knowing what you're doing. And they let you they let you break the assumptions of the underlying statistical tests. So this is a this is a slightly different questions in bioinformatics. And

**Bret** 59:17

but it's also a question about how many strains there are. And so I don't know, just as deciding whether some creatures a member of a different species are the same species is something in which we just have a standard, there's certainly going to be a standard for the strain. There's the caveat that we have said several times, which is that there are certain to be a huge number of strains that are never detected because they're so quickly dead ended. And so when we say is there another strain, what we're really saying is has some strain succeeded enough that we see it? So I don't even think the question, you know, not your question, but I don't think the question how many strains are there is a good question. I don't think it's an answerable question. How many strains are successful enough that we need to worry about them as distinct evolutionary phenomena? That might be a good question. And do I trust me The problem is phylogenetically speaking,

**Heather** 1:00:17

which is the deep history, the

**Bret** 1:00:20

history of relatedness of critters, whatever they are. I do trust those models to the extent that they minimize the assumptions, right? So the does it gonna throw a lot of people but the tradition that we come from is one of parsimony. And it distrust maximum likelihood, not that maximum likelihood doesn't actually work. But the problem is maximum likelihood introduces assumptions about relatedness, that are certainly going to be sometimes true. But

**Heather** 1:00:55

everything is specifically rejects Bayesian analysis within phylogenetic inference,

**Bret** 1:01:00

right? So anyway, if you take a narrow a strict parsimony approach, then there's almost nothing that can be wrong with phylogenetic systematics other than maybe the assumption of bifurcation. But in case of these viruses, probably by application is a fair assumption

**Heather** 1:01:15

bifurcation, just meaning that one, one population turns into two, rather than one population simultaneously turns into three. Yeah, you don't the assumption is that you don't have trifurcation propagating evolutionary events, you have

**Bret** 1:01:28

bifurcated, otherwise, we now that I think about it, there's no reason that a virus couldn't infect a virus might person. And then I mean, you know, other creatures do this, too, there are certainly ways that you can get a poly Tomi, which is one of these multiple things springing from the same node. And not boring the crap out of most people, but we're just getting interest, right? But anyway, the point is, painting with a broad brush, the assumptions about phylogenetic systematics, and the model that it uses is so dead simple, there's almost nothing that can be wrong with it other than some pattern that doesn't fit, you know, if you have two branches of the evolutionary tree that then come back together, then that's not going to be mapped on to a program that assumes by application, right. So that sort of thing can up end it. But in general, if we're trying to figure out how many strains of the virus there are, that's not a complex question, and so you don't have a highly complex mathematical model that can up end you, you have a very simple mathematical model. And what you're doing is shoving lots of data at it. And the more data you have, the more it drowns out the noise, and the better you can see. So that's all pretty secure. So anyway, that's to make a long story short, I think there is a reason to trust some sort of broad brush analysis that doesn't get out over its skis about how many strains there are. But how many strains there are doesn't mean how many strains there are, it means how many strains are we seeing actively spreading?

**Heather** 1:02:57

over an hour, okay. Let's just at least let's get through to more. And again, we're missing so many for which we apologize. Thank you again, for treading water publicly. You both are doing so swimmingly, like the pump. Eric seems to publicly disagree with the viability of a game be solution, however, doesn't have desirable alignment, alignment in game a suffer from high fragility with respect to stability. alignment.

**Bret** 1:03:42

disability, I don't know

**Heather** 1:03:43

if the alignment refers to people or ideas. I'm not sure.

**Bret** 1:03:47

I mean, look, certainly, Eric would agree with the fragility of the system, and that some evolution like force has made that fragility. All the more elaborate and dangerous. We have almost hyper fragility. I'm sure he would agree painting with a broad brush. Does he really disagree with the idea of the possibility of a game be solution? I don't know. Maybe that's something DNI to

**Heather** 1:04:18

Well, he's talked, I listened to a bit of his talks with Daniel Trachtenberg. Yep. And that, you know, he. I haven't listened to all of them. But I think I'm more familiar with Daniel's position than I am with Eric's objection to it. And they're basically starts by saying, you know, call me suspicious, or not suspicious Color Me skeptical. But I'm listening. I just I don't I don't see that people can get there.

**Bret** 1:04:46

Yeah, which now, I mean, look, there are several questions tied up here and we don't have time to go into all of them. One is, is there a system that could be reached, if we could teleport, rather than Figure out how to get there. Is there a system that would be stable and have the characteristics that we would agree again, be solution would have to have in order to be called that? That's a different question, then can we get there from here, which might be impossible, even if the place to go actually does exist? And so which of these things Eric is skeptical about? My guess would be that, you know, if he says, he doesn't trust the people can get there? That's a navigation question. It's not a is there an evolutionarily stable strategy that would accomplish the goal? So I'm also skeptical that that we will get there. I think it's plausible, I think it's worth pursuing until we know it's impossible, because otherwise, I don't know what we're going to do. And Eric solution of let's get off Planet Earth is frankly, not very helpful.

**Heather** 1:05:50

Could I'm not sure I know what this next question is, we may go to another one. But we'll read it put the missing mechanisms be a kind of Kaymer ism, where two organisms come together to form a new organism with a new unique ability.

**Bret** 1:06:04

That could be one element. We've talked before about the fact that hybrids appear to be more common than we tend to imagine, into something that I've actually seen in the wild where I've had animals in the hand that don't key out to one species or the other. But there will be many mechanisms that free evolutionary exploration from the constraints that would come from a simple waiting around for random mutations to change proteins enough to alter morphology in order to get to some new way of doing stuff. That's the simple fact. And you know, it's kind airism one of them Well, I know one instance of chi marrows in biology that solve a major evolutionary obstacle. You know what I'm thinking? Yeah,

**Heather** 1:06:57

they're so cute caltric in monkeys, and this is known to most people as marmosets and tamarind llama sets and Tavern American, just barely up into Central America. Cute little guys.

**Bret** 1:07:07

Yeah, cute little guys. So anyway, they are obligate twin bearing. And they also have offspring that require tremendous amount of care. And they have a difficult niche,

**Heather** 1:07:17

tiny, and their offspring are a big proportion of the body size. So mom has a hard time carrying them as they're arboreal and all this.

**Bret** 1:07:25

So anyway, they're one of the few species in which we see something like polyandry, which is multiple males. And anyway, for a long time, I thought it must be that they were identical twins, which would solve the question of why the males put up with

**Heather** 1:07:39

the two male mates of the mother that the three of them going around co parenting that the two fathers were identical twins is what you're right,

**Bret** 1:07:46

which I you know, in, I almost failed out of graduate school on this basis, because I knew they were behaving like identical twins. And yet, the evidence said that they were not identical twins. And that just didn't fit. So I basically kept making that point that they really have to be identical twins and the

**Heather** 1:08:03

professor's all of whom, in this case, were actually really excellent. just kept saying to you, yes, but it's not true,

**Bret** 1:08:08

right. But is it true? No, it's not true. Okay. But anyway, it turned out years later, that chi airism solves the problem that I thought that identical twins would solve in a way that I didn't think to predict because basically, in the womb, males exchange tissue. And so you've got brothers who are not one individual or another, each brother is a composite of the same two genomes, and therefore when one brother reproduces, they are passing on the genes that they both carry. So it's

**Heather** 1:08:37

actually be that if brother a has has sex with their shared mate, it may actually be brother be his genome, that he spreads through his sperm.

**Bret** 1:08:46

Am I really I'm realizing in this moment, saying there is no brother right? And brother B, they're both A and B.

**Heather** 1:08:54

So it's individual. Yes. Something like

**Bret** 1:08:56

identical twins.

**Heather** 1:09:01

We circle Right, right. Yeah. But I mean, there's still individuals, right? And when there's still individuals that you can look at, and yes, genetically, they are not genomically individuals, right? But they mean you can you can look at them and say okay, that's Yeah, that's Steve

**Bret** 1:09:13

over there a collar on one of them. And yeah, there's nothing

**Heather** 1:09:17

I like the fact is that even if even if this guy wandered off for two weeks during her fertile period, and this is the only one having sex with their mate, that the guy who had wandered off may actually turn out to be genetically the father of the resulting offspring because of the Congress.

**Bret** 1:09:32

Well, I still think you can't even say he may be the father because what is he and my point would be actually, it's a very

**Heather** 1:09:38

clintonian thing you just said. Okay, I do want to just quickly one more question before we stop. What are your recommended books or sites for the curious layperson that align with your views on gender? Your comments, patriarchy is a myth, for example, piques my interest. I do not want to be misled. So This I would love to talk about as well for a long long time. I don't know of anything that does a beautiful job of this you know there's a chapter in our book which won't be up for a year ish on sex and gender, Mother Nature by Sara Blaffer. hertie is extraordinary. I've mentioned that on this on this live stream before a little bit, my piece called on toxic femininity, which was published in Colette a year and a half or two years ago. Gets gets at some of this.

**Bret** 1:10:32

Our segment on Joe Rogan's podcast Yeah,

**Heather** 1:10:35

which whatever we're gonna we were both on, we talked about it. But in terms of terms of other books that are out there, Sarah properties is the one. It's called mother nature that comes to mind. And then I know there are others probably probably Bobby Lowe's book sex matters. These are all books that don't focus on human so much. I don't know if you know, Laura, Betsy has any books out but I can sort of name some of the names Barbara smarts on baboons.

**Bret** 1:11:08

strassman,

**Heather** 1:11:09

every straw Beverly strassman, who worked on the Dogan, people in Africa. So there are a lot of terrific biologists and anthropologists who are looking at sex and sex roles. And what is the what is called sex role in other species we call gender in humans. It's the same bag as the behavioral manifestation of sex. And also there's a whole lot of interesting stuff out there. And if you know, maybe we will continue to address that I certainly helps out. All right. All

**Bret** 1:11:38

right. Well, this has been excellent. As usual, I will ask you, please, if you have not already subscribed to the channel, like the video, pass it around, and let us know what you think in the comments. We will see you on Saturday at 1230 Pacific. In the meantime, be well everyone