Bret and Heather 5th DarkHorse Podcast Livestream\_ Why Covid...

Sat, 10/9 12:51PM • 59:38

**SUMMARY KEYWORDS**

people, hemoglobin, virus, oxygen, question, ventilators, pneumonia, malaria, thinking, mask, case, biden, fact, lungs, point, live stream, strand, mechanism, bit, gas exchange

**SPEAKERS**

Bret, Heather

**Bret** 04:39

Hey folks, welcome to the Dark Horse pods podcast we are doing our fifth live stream with Dr. Heather Hyang to my right. We are going to be talking today as we have been about the developing situation with the covid 19 virus and the global lockdown that we are all Facing. First we are going to start with some business. And then some corrections. The business I think involves alerting people to the fact that we are as we did a couple of weeks ago, we are still experimenting with different ways to make this all function. But we are going to do something on the order of a half hour to 45 minutes of live discussion. You can file super, super chat questions during that time. And then we will address those questions in a separate live stream, which will be linked in the description to this live stream. After a few minute break. Hopefully this will all work out. Hopefully you won't face any lag on your end, we are still working out the technology behind having the podcast here. And so if there are any technical glitches, please bear with us. We're doing what we can.

**Heather** 05:57

So just to be to just be clear, just like in our third live stream, we're gonna have a conversation with each other here for half an hour to an hour, 45 minutes or so. Please feel free to ask Super Chat questions. During that time, we can't see any of the chatter the Super Chat Zack our son and tech support and producer is doing all that work behind the scenes. And then we'll take a break brief break and then come back with the second live stream immediately afterwards. And address hopefully all of the Super Chat questions that you have asked during this and during the second q&a livestream.

**Bret** 06:30

Great. All right. So let's start with two corrections. I have two corrections this week. And then I have a note about something we just discussed at the end of last week. The two corrections are as follows one, I said that I thought it made sense for the pope to issue a decree which I think would be called an encyclical that declared cremation to be a viable form of body disposal for Catholics and the Pope has done this but apparently he did so in the 50s. So I'm a little bit behind the curve on that. Now it doesn't change the point very much I still think it would be wise for the pope to say something clear about the desirability of dealing with bodies fast enough such that even if people in Latin America are desiring of a a more traditional burial that the priority here probably involves bending those expectations a bit and and getting the system back to functioning which could mean larger scale cremation or it could mean temporary burial of bodies in a way that they could be exempt and re buried later which one of the Ecuadorian officials did release a statement saying that it was very important that these berries these bodies be buried individually with proper ceremony. So anyway, these two things are in tension even if I had the the cremation point wrong. The second issue involves the Theodore Roosevelt, the aircraft carrier, which docked in Guam and the commanding officer was, I believe, suspended by the Navy. And I had declared him an admiral, which involves two errors. He apparently was not an Admiral. He was the captain of the Theodore Roosevelt but not an Admiral. So that's one error. The other errors I apparently don't have the power to promote him. So hope Yeah, you're bad. Yeah. Maybe that can be addressed before the next podcast. But all right, the third

**Heather** 08:37

if you want to promote a now canceled, oh, no.

**Bret** 08:41

I want the power to promote IC M to the rank of Admiral I support this. Okay, good. All right. Third thing involves a weird bit of happenstance. As we were doing our last livestream, Joe Rogan had my brother on, which I did not know was coming. And they had a discussion which caused a lot of interest in which Eric said something very much like what I said about if the democrats were to nominate Biden that we would be unable to vote for Trump, but wouldn't vote for Biden and Joe Rogan said something truly provocative, which is that he, in fact, in that event would vote for Donald Trump, which,

**Heather** 09:23

which is, which is a match for what you said and what you've said to me for weeks now. Which is that the DNC promoting Biden and having Biden be the other candidate is perhaps the only argument that you could see for voting for Trump. Yeah, I won't, I won't do it. But, but you can, but you could see it being the only argument

**Bret** 09:44

that said what I what I said last livestream was that in the event that the democrats make the incredibly foolish choice to nominate Biden and I realized nomination is supposed to be a result of the way the party votes, but that in effect, there's been a very coordinated effort. to rally around Biden and to shame Sanders, for example into it's supposed

**Heather** 10:04

to be held the populace votes, but it would appear to be top down from the party at some level

**Bret** 10:09

top down from the party. And of course, the party is structured to game its own convention. And there's a lot of a lot of behind the scenes stuff. But in any case, what I said was that in the event, they nominated Biden that it would justify what I called mutiny. And I wasn't deliberately vague about exactly what that meant. However, in in, if we put that up next to Joe Rogan's statement that he's going to vote for Trump, in that case, I would say, voting for Trump would be a pointless waste of the opportunity that we will have been forced into. And, anyway, Joe, I'd love to talk to you about what a proper mutiny would look like. All right. You have any corrections for this livestream?

**Heather** 10:54

Not that I remember to put together so they'll they'll come later if, if I'm, if they're brought to my attention.

**Bret** 11:00

All right, great. So where should we start? Well,

**Heather** 11:03

we wanted to, I think, spend time today talking about whether or not COVID-19 is being treated the right way and understood the correct way with regard to its mechanisms of action. Right? Yes. So, you know, at some level, the question is, if this is this is a respiratory virus, and it appears to be it has been widely reported as producing pneumonia, which causes people to be unable to pull enough oxygen into their lungs. And so respirators and then ventilators are the go to go to treatment. And once people are put on ventilators, the rate of the fatality rate is incredibly high higher than it is under normal cases of people with pneumonia having to be put on ventilators which just just that single observation, right there begs this question of what what is so different about pneumonia caused by SARS Cove to than other pneumonia, pneumonia being a very broad description of a sort of a class of, of respiratory situations that can be caused by any number of things. And I would just, you know, caveat again, as we've done in at least a few of these other ones, we are both we both have PhDs in evolutionary biology, but we're not biochemists. We're not molecular biologists. We're not MD is so you know, a bit outside of our wheelhouse with regard to molecular mechanism here. But the question, the question that's being raised is what you know, at one level, why are ventilators proving the thing that is necessary for so many people here and yet so much less effective than it is in other cases of pneumonia? Therefore, is it in fact pneumonia? And is it acute respiratory distress syndrome, ARDS, which has been raised as a particular issue in a increasingly popular now. YouTube video zacky might just put this up,

**Bret** 13:05

hold on before before we get there. Let's let's talk about some of these.

**Heather** 13:09

Look, let me just say that so that you don't have to put it up yet, Zack, but this is Dr. Cameron, Kyle's Adele, from my Orpheus, Bronx, Queens, New York City area ICU in which he says I don't think we're doing this right.

**Bret** 13:21

So I should say this was a topic of discussion for us for several days now. Not yet this video came to our attention, which reflected a theme that we were beginning to wonder about for other reasons. So that's doubly confirming that there might be something down this road if we were beginning to think something about the story isn't right. And then we find another source, especially somebody who's on the front lines of treating these patients that that reinforces the idea that there's something

**Heather** 13:49

to it, you want to talk about some of how you you first came to be thinking first

**Bret** 13:53

thing I want to say is that I think we are going to get tangled in this question of pneumonia, and we shouldn't get tangled in the question of pneumonia. The fact is, pneumonia is what we might call a syndrome. It is not the result of a particular pathogen or even a type of pathogen it's basically defined as inflammation within the lungs that interferes with gas exchange. And that can be caused by bacteria. It can be caused by viruses, it can be caused by any one of a number of things, but it shows up more or less as fluid in the lungs, which is more opaque on a scan than the lungs should be.

**Heather** 14:29

So a little a little bit like HIV causes age, age, HIV causes AIDS, but people generally die of some secondary infection, right? So SARS go to causes COVID-19. But people often are dying of some kind of respiratory distress, which has been often classified as pneumonia

**Bret** 14:50

right now, I've decided that I'm not very interested in whether it is or isn't pneumonia. I think the point is, there are severe risks. respiratory symptoms, what is important to figure out is, in light of all we don't know about COVID-19, the fact that there seem to be I've heard it described as two. But I think it's really three trajectories, there's an asymptomatic version, there's a relatively mild symptomatic version. And then there's sort of a catastrophic decline. And if you end up in that third category, what happens to you is pretty dire. But one question is, is it that at the point that you kick over into this third category, that you're already in such serious shape that a rescue that a respirator or ventilator can't help you? Or is that not the right treatment? Because we've misunderstood what it is that characterizes that phase

**Heather** 15:51

might in fact, be counterproductive? as a treatment, right? Like might as Can we just show this, not the video, but if you want to just put on the screen, the thumbnail from this video sack so people can see again, it's Dr. Cameron Kyle sell. His argument is that what he's seeing in the in his ICU is not people who look like they have pneumonia with all the caveats we just made. But it's it looks to him, like people are on a plane at 30,000 feet, and the pressurization on the plane is gradually going away. It's like people are having acute altitude sickness that they are unable to, to they don't have the oxygen that they need, as opposed to, they cannot, they cannot bring up the muscular strength, the lung muscle or the neurological ability to to do the respiratory actions that they need to use the oxygen in their bodies, like they just don't have the oxygen actually available. And resume probably it seems this is because the virus itself is grabbing oxygen, but that's what it's hungry for

**Bret** 16:59

well, so as a virus, it has no need for oxygen. So it's not grabbing it for its own purpose Hungary.

**Heather** 17:06

Exactly, yeah,

**Bret** 17:07

but but the picture that is emerging, and again, I don't know if this picture will turn out to be false as well. But the picture that seems to be emerging is that the virus, as a matter, of course, is interacting with hemoglobin molecules. Now, for those of you who have not studied this, hemoglobin is an absolutely stunning feat of engineering without an engineer, and ancient, absolutely so ancient and necessary to the functioning of a large creature like ourselves that is very active, and therefore requires a lot of oxygen to do the metabolic work of motion. But the thing that's so stunning about hemoglobin is that it has this capacity to have an extremely high affinity for oxygen in your in the environment. And then it picks up co2 with a very high affinity and drops it off. So it's picking up Hema, it's picking up co2 in the tissues of the body where metabolic work has been done, and dropping it off in the lungs, where it then picks up a lot of oxygen and moves it into the body. And so it is the molecular mechanism of gas exchange. It is Yeah, it is the molecular core of gas exchange. And the thing is, to the extent that that molecule is failing, it predicts a whole slew of other failures downstream, including the heart, obviously. So you've got this very hard working muscle that even when the rest of you is at rest is still pumping away. And to the extent that the hemoglobin itself is under attack, that predicts the the heart, the lungs, and everything else in the body is going to be facing this extremely difficult problem to solve, which is how do you do the work of repair and fighting when work is being slowed down? It's like a supply chain problem inside the body. So there's a question about why COVID-19 seems to be interacting with hemoglobin. But what does is becoming increasingly clear, and I must say the one thing I'm learning is what happens when normal academic publishing, there's no time for it. And so there's now a literature evolving, that actually has done something very interesting, which is it is bypass peer review, because there's simply no time and it's now happening on these preprint servers where papers can be published by anybody within a particular field. And you can read them right away. They haven't been vetted, but they can be actively discussed. And it's actually a much healthier environment. In almost every way, then the peer reviewed much slower, more deliberate and, frankly, more corrupt.

**Heather** 19:53

There's more of them. There's more to go through. It's too fast for a normal situation where you might want to be looking Get topics across 300 top, you know, 300 ideas, right? Whereas right now, okay, what's coming out now on the preprint servers with regard to say, is, you know, this particular one you're talking about is this view and Lee and probably mispronouncing your names 2020. Paper COVID-19 attacks the one beta chain of hemoglobin and captures the porphyrin to inhibit human heme metabolism. It's, you know, it's, it's just on a preprint server. That's the only place it exists. It is clearly in draft form is some some of the languages Not yet. Not yet grammatically correct. Or in some cases, I think even quite scientifically correct. But it advances several ideas that, that the authors have vetted, it advances a few hypotheses. And it's got some some just extraordinary ideas, that under normal circumstances, we wouldn't have even been able to have seen this probably for a year or more, or at least, you wouldn't have gone looking at the preprint server because you wait for the journals to go through the peer review. And to put things out such that if if something turns out to be wrong, the editors and the journalists and the authors all have to answer for the fact that they did something egregious.

**Bret** 21:13

So to be clear, what we've got is we've got at least one emergency room doctor. And I've now seen others describe similar things, who is saying what I'm seeing does not match what I would expect for an epidemic of virally caused pneumonias matches what I think I would expect from hypoxia as a result of altitude. But these are people at sea level, what's going on. And then you've got this paper saying there's a molecular mechanism whereby COVID-19 is attacking the porphyrin molecules, heme complex of hemoglobin, and it is, I think, freeing the iron. So again, hemoglobin is a very fascinating thing. It's a protein that holds these iron atoms in a particular location. And you know, from elsewhere, that iron rusts, that's irons propensity to interact with oxygen. So that propensity to interact with oxygen is being utilized by creatures like us to transport both oxygen and carbon dioxide, in this reciprocal process inside of the body. And this virus is attacking it directly and what it may be,

**Heather** 22:24

and then releasing me said this, but and then releasing the iron, which in this form, is toxic, and it's becoming free floating in the blood.

**Bret** 22:32

So you have this reactive molecule in the blood and the iron, it's not being held in the hemoglobin, which is the structure that facilitates the gas exchange, that would be useful. You've got patients who look like they're starved for oxygen, you've got doctors, putting them on a machine that attempt to deal with the starvation of oxygen, mechanically, right, when this may not be a mechanical problem at all. Now, again, we do not want to pretend that we're the experts on what should be happening here. We can't even say that the story we've just discussed with you is true. That's to the extent that it's replacing another story. This one could also be not true. And there might be some deeper explanation. But there is a question about if this were the case, would it explain anything that we're seeing? And does it suggest anything about what should be tried? So for example, if your blood is being denuded of functional hemoglobin, could you be saved by a transfusion of blood that had intact hemoglobin which also I would not

**Heather** 23:35

just not just a plasma transfusion has been discussed with regard to getting antibodies from recovered COVID-19 patients, but actually full blood that that has hemoglobin, and it has

**Bret** 23:46

hemoglobin in red blood cells and things. But it also raises the question now, I don't know somebody's likely. I mean, surely people know. But the experiments that suggest that there might be some value of injecting, is it just plasma that they've injected from people who've recovered that seems to be protective? Or I believe it was blood transfusions? Was it not?

**Heather** 24:05

Both have been both have been proposed? I don't know if both have been enacted yet.

**Bret** 24:09

So this raises the question. If it is blood transfusions that have shown promise in treating people blood transfusions from people who have recovered, it is possible that we misinterpret the reason that they function, it may be that they're rescuing people based on just the simple fact of functional hemoglobin that hasn't been attacked by the virus yet.

**Heather** 24:30

So I mean, these are you don't want to experiment on sick patients. But how would we know right? You know, the experiment would be that you give sick patients intact blood, some of which is from people who have recovered from COVID-19, the seven which is from people who have never been exposed to COVID-19. And the prediction here of the hypothesis that it's not the antibodies, but the hemoglobin is that people have no difference in recovery between those two situations. But, you know, under these circumstances, you don't want to argue We should be experimenting on patients. And yet that is exactly that is the only way to know I mean, I guess, unless we can use animal models, we now know that for instance, cats can get it.

**Bret** 25:11

Yeah, I don't know how good a model right other creatures are. But I would say this is raised another question, which is, and you can see this in the debate about about chloroquine is there's a question, and you know, this is a famous and old question. And there is a relaxed set of standards for people who face dire circumstances. And you know, drugs that aren't known to be safe can be utilized, in some cases, because the person has very little to lose. So in this case, we now have a number of things unfolding together that force us to ask questions, we don't usually ask like, what do you do when a crisis is facing the entire world, your normal mechanism for dealing with that where you might have too much of some equipment one place, but you can always move it somewhere else, you know, the way we do with firefighting equipment, when, you know, part of the West catches on fire, and crews move in from somewhere else, you can't do that, if everywhere is on fire. And so we have that problem with this virus. I know our governor, okay, and state of Oregon and the state of Oregon, just arrange to send 140 ventilators to New York, I'm told that in exchange, we're going to get the Brooklyn Bridge, which I think is going to look great across the Willamette River.

**Heather** 26:32

I was hoping for the Statue of Liberty, but really,

**Bret** 26:34

okay, well, either way, I mean, I'm sort of hoping for the bridge. It's a pretty one. But either way, I have a lot of bridges. That's true. But anyway, we've got these new these new questions about what you do when a system is stressed in every place at once. How you navigate a live fire exercise with respect to a health crisis, at the same time that you're trying to study. This that's that was that issue was raised by the question of the docking of the Theodore Roosevelt. And what I argued should have happened with this unique, isolated group of people who apparently had been transmitting the infection and how much we could have learned and how much opportunity cost there was for just docking it. And not

**Heather** 27:21

just with it, I mean, just to remind people in the last livestream, I believe what you said was, we at least just needed to take the data, the data that were easy to take, and it would have been great if we could have asked for them also, to report out on who they interact with over some number of days, but even just collecting data on who was second, maybe what rooms they shared.

**Bret** 27:43

Well, and I did more thinking about it afterwards. And I realized, you know, these nuclear powered ships, especially an aircraft carrier offers an entirely other possibility, which is, if anybody who was in the chain of command that forbid the captain from from docking, his ship, was thinking about the possibility of understanding, I doubt it was on their minds. But if it was on their minds, that this was actually a population worth knowing something about the fact that the ship didn't have the resources to properly handle these cases, and that everybody was in tight quarters, would have allowed, you know, the thing at the very least, has an airport on its surface, that's what it is, it's a floating airport that's nuclear powered, we could have docked it somewhere. And we could have brought in resources, you could have built a hospital on those decks, to separate people treat them properly, you could bring in whatever medical resources were necessary could have been done well, and I don't know what the value of the information we would have gotten from this population whose limits we knew, but the opportunity that was lost when we just bypassed that over the human concerns alone was large.

**Heather** 28:59

Yeah, for sure. One other thing I wanted to add with regard to the question of SARS code to attacking a basically getting at hemoglobin and getting rid of the iron and making it more difficult for gas exchange to happen within humans and some other mammals to is a prediction that if this if this is true, that those populations of humans who are adapted either genetically or otherwise but even more so genetically, to living at high altitude, will potentially be less susceptible to developing extreme symptoms of covid 19 I would not predict that they would be less susceptible to to being infected with SARS coattail but that once infected that they would be less likely to to show extreme symptoms and so we you know, there's a in the Himalayas in particular, and actually, you know, this was I pulled up the paragraph in And the book that we're writing right now on exactly this, and it's, you know, it's first draft form. But in that in the homology is in villages of 4000 meters or above as 1300 feet above sea level, there's a genetic variant in the oxygen levels in blood that allows people to store 10% more oxygen in their blood. And women who have this variant have hot, much lower child mortality rates than women without it, which suggests that absent a lot of gene flow between between these populations and populations at lower latitudes, lower altitudes, rather, that you would expect this to spread absent, whatever cost there is, right there, you know, this this thing, this variant, this genetic variant, in this case, must have some cost, else, presumably, it would have spread through the limited gene flow that does exist between the Himalayan Himalayan populations and the rest of the world. And we'd all have it. So there must be some cost, which is unspecified. But right now, it's probably mostly benefit. Again, the prediction Being that this would be beneficial in the fight against being highly symptomatic with COVID-19.

**Bret** 31:12

So there are a bunch of things actually, that's that fit in this rubric a, we can infer that you're right, there must be a cost to this extra capacity to deal with low oxygen, because we also know that when people who live at low altitude go to high altitude over time, they accumulate the capacity. So it must be an efficiency concern that causes

**Heather** 31:34

which is, it's an acclamation process rather than a genetic change. Of course, it's individuals within a lifetime.

**Bret** 31:40

So that validates the the point you're making. It is also likely that this plays into the fact of this having originally apparently come from a bat, whether it came directly from a bat, or it came through another species like pangolins. The thing about bats one of the things about bats is that the very fact that they fly means that they are incredibly high throughput with respect to oxygen and carbon dioxide. You can imagine the amount of work that is necessary to keep a you know, a small mammal in the air that that requires incredible feats of both mechanical breathing, but also gas exchange. And in fact, if you listen to the calls of flying echolocating bats if you have a detector that allows you to listen, you and shoe well sure. The animals echolocate. Under normal circumstances, they echolocate in rhythm to their flight. So you can actually watch them fly over and you can hear them coordinating their breathing because they're basically their flight muscles are doing part of the work of this basically functioning like a ventilator,

**Heather** 32:53

or like an accordion in terms of noisemaking. Yep. So

**Bret** 32:57

anyway, the fact that bats have this very high throughput of oxygen, and that when this virus has gotten into people that has caused what appears to be a kind of oxygen, oxygen starvation may not be, they may be two sides of the same coin. And it may suggest things that we should research about, about the virus. even farther afield, and I really don't know what to make of it. But it is conspicuous that chloroquine, or hydrochloric mine, is it it's hydroxychloroquine, or Quinn has been implicated as a potentially useful drug against COVID-19, which is that first pass not it seemed like it was completely out of left field because a malaria, which is the drug for which this is usually used, is not a virus. It's a Plasmodium. And so the idea that these two drugs that the drug

**Heather** 33:53

would end sorry, interrupt, but other than fever, it seems to have nothing in common, right, very

**Bret** 33:57

little. But on the other hand, you will maybe remember from a biology course, you took at some point that people who are heterozygous for sickle cell anemia, so this has been a common trait in African derived populations, people who are heterozygous, that means they have one gene, one illegal for and one illegal for the normal wild type. For sickle cell anemia, are actually resistant to malaria.

**Heather** 34:28

So let's just spell it out that most people who don't derive from African populations within the last 30,000 years or so, are homozygous and do not have the gene for in quotes. And some people who are homozygous for it and have both copies. Those people tend not to survive into into adulthood and reproduction. But people who are heterozygous, who got a copy of the allele from one of their parents Got a copy of the so called wild type allele from their other parent have increased resistance to sickle cell anemia.

**Bret** 35:06

Yeah, wild type is the wrong. Yeah, it's totally the standard type. Yeah, the way to say it. But the reason that this is important is that sickle cell disease is actually named after something you can see in a regular light microscope, which is the distortion of the shape of red blood cells. As a result, I believe of the hemoglobin molecule actually gumming up the cell in a way that looks sickle shaped. So it creates these sickle cells. Now if if all of your blood cells look that way, because you have two copies of the sickle cell illegal, you can't transport enough oxygen to survive into adulthood. But if you only have part of your blood compromised, then you find yourself in a situation where you would pay a cost under normal circumstances. But in a place where there's malaria, your blood doesn't carry enough oxygen to support the Plasmodium so you're effectively immune to malaria. So what the connection means, I don't know, I think I

**Heather** 36:03

just misspoke when I was talking earlier, how being heterozygous for sickle cell gives you a slightly increased chance of being sick from sickle cell anemia then if you have no copies, but it creates a great advantage with regard to fighting off malaria. I think

**Bret** 36:19

it creates a sub symptomatic sickle cell disease, which means if you were to measure the ability, like

**Heather** 36:26

you might not end up being exactly a pro athlete and be

**Bret** 36:29

a star. Yeah, but under normal circumstances, you can move enough oxygen to be to be functional. So what then is the connection between hydroxychloroquine which is fighting malaria, and the oxygen capacity of the blood, which is manifest at a low level, which is protective against malaria, in heterozygous sickle cell carriers, and this novel Coronavirus effect where it is apparently depleting or seems to be depleting blood of functional hemoglobin? The connection, I couldn't spell it out. But there does seem to be something in that grouping of observations, that suggests a potential mechanism for addressing this and raises real questions about whether or not ventilators being applied to the most sick are doing more more good than harm or more harm than good. That's right. Yeah, so it's a it's a very interesting puzzle, I would say.

**Heather** 37:34

It's, it's incredibly interesting. Boy, I feel like there were a number of things that we wanted to go to, but maybe

**Bret** 37:44

there's one more thing I want to add, I was doing a little reading on the mechanistic side of COVID-19. And I ran across a bunch of stunning facts about how it functions. It's really how the disease functions how the virus function, SARS, cov, to function, how it gets into yourselves what it does, once it's there, it's really, you know, if you can put aside the, the massive damage it's doing to humanity, you have to marvel at what gorgeous feat of engineering this thing is, I mean, it's just stunning.

**Heather** 38:20

And when you say engineering, you're not suggesting that it was engineered by

**Bret** 38:24

Nope, engineering without an engineer, the evolutionary process. I mean, this is an ancient ancient object. This thing is a machine that has been traveling with mammals, presumably for who knows how many million years but probably 10s, maybe hundreds of millions of years, it is an amazing object just in terms of what it is capable of doing automatically upon, coming in contact with a cell for which it has the, the correct apparatus to invade. But among the weird things about it, it's an RNA virus, which we've talked a little bit about before, it is a, it carries the sense strand of RNA, which means that the genetic material inside the virus is directly readable by the ribosomes of the cells that it invades. It has a bunch of tricks for how to take this long genome and get it transcribed by these ribosomes, which in general limit their transcription to one protein at a time. So it has to fool the ribosome into doing its bidding, which it has all these elaborate mechanisms for doing. But the thing that struck me most was, apparently this thing has an incredibly large genome for a virus. It's actually right at the limit of what we think is possible for an RNA virus without it succumbing to so much mutation that it can't be coherent. So somehow this thing is full of information. And why it's so full of information. I don't think we know yet. But that raises all kinds of possibilities about what it will do in response to the evolutionary environment, it has just discovered that is us, how will it evolve?

**Heather** 40:09

And as we've talked about earlier, you know, how will it evolve both with regard to in our bodies, but also in the environments in which it finds us? You know, will it become seasonal? Will it become inversely seasonal in the northern, northern and southern hemispheres? Will it do better in say, humid environments than dry environments, etc?

**Bret** 40:28

And maybe most importantly, at the point that we do come up with some sort of vaccine? Will it be a vaccine that actually addresses this virus? Or will it be like the flu where we're constantly chasing it, because it has a mechanism for morphing so that it is no longer effectively dealt with by the vaccine we come up with, which maybe this is the last point I should make on on these technical side, but it appears that it remember, it's an RNA virus, which means one strand, which means there's no built in automatic mechanism for correcting mutational errors, right? If you have two strands, you can always rebuild the strand based on what the inverse strand says, in an RNA virus. That's not true. But one of the things contained in this very long genome apparently, is a mechanism that is now thought to be an error correction mechanism. So there's a lot to be said for what might happen if that mechanism is sometimes turned off. In other words, for a virus, there are surely some moments at which it makes sense to go into a high rate of change mode in order to evade a successful strategy and a successful counter strategy. So is it is there a switch to turn it on and off?

**Heather** 41:45

I don't know, Oh, that's so beautiful. And it just it points, it points once again, to our arrogance, right? That that we imagined, we imagined in the 1950s, that with the discovery of DNA, the shape of DNA, that we had it, we knew what was going on, and, and that was it, DNA to RNA to protein, boom and done, right? And, and because DNA is double stranded, and therefore has this error correction, that we can all kind of Intuit that we owe, if you've got two strands that match each other, basically, that if one mutates, you can, it can be corrected with the other. I know that there are people who have been working on this further, but at least in terms of, you know, biology textbooks outside of the research on that, in particular, like that's error correction, that's where it is, that's all, that's all you need to know. But the idea that within an RNA virus, there is an error correction mechanism, the likes of which we can't, at the moment, neither of us can describe particularly. And it may be able to be switched on and off at particular moments for particular situations, the world is stranger than we can believe. And imagining that we are dealing with simple systems that will have simple solutions will be our downfall. We need to recognize the complexity and and admire it and work hard to understand it.

**Bret** 43:12

Well. The other thing I would say is, you discover that such a creature, I use the term creature loosely but you discover that such creature exists at the point it starts making people sick. The proper thing to do is to manage these things, so they don't get into the human population. Once the thing is loose in the human population, and we're spreading it to each other. This is a you know, we are not going to win this battle, we might eventually drive this virus to extinction, but well, we will it lost many, many people before that occurs.

**Heather** 43:45

I mean, I think as you said on maybe our very first live stream, it doesn't want to kill us. Nope. Right? That is that is not its goal. And so what would win me and you know, if when for us, if the only possible way that wind looks for us is driving it into extinction, that is a that is a much harder situation to to do. Whereas if living with it extent for some number of its generations, such that we can come to coexist peaceably ish, hopefully more like we do with the cold and less likely with less like we do with, say, the flu, and certainly far less like we do with HIV or Ebola, then, you know, is is that a win? You know, can we can we really imagine that the only way to beat pathogens is to drive them into extinction. It is really unlikely and even if we do that with one or two, we will never do it with all of them. Well, therefore we need to rethink what our relationship is with them. We do need

**Bret** 44:46

to rethink our relationship. I still say the the best bargain is always to keep these things from jumping the gap. True. Once they're once they're with us. We're managing them at great cost to ourselves. So the gap that you Is the host gap. Yes. And you know, I've been thinking a lot. I've been through so many discussions now about whether a bandanna is an effective remedy, not an effective remedy. And this has got me thinking a ton about this. Now, as I mentioned, you know, I think our first live stream before the COVID-19 phenomenon years ago, I had wanted to run this experiment with a class of students, where I had them wear bandanas over the winter to see if we could manage, you know, reduce the level of common colds and flu. And I never did it. But I'm realizing that okay, I'm now finally weeks after I started wearing this thing, I'm finally seeing other people wearing them and other kinds of masks as we interact with each other. I am wondering what this will do to the flu and the common cold. But I also think what I really don't want to see is we went against COVID-19. And we forget everything we learned about how we've been transmitting viruses to each other, you know, every winter for you know, longer than any of us have been alive. So why are we not talking about bringing this into future winters in order to just reduce the level of transmission of the flu to as close to zero as we can get it? I really think it's a, an avenue, we should be thinking about,

**Heather** 46:25

you know, reduce transmission of the flu, but increase stickups at liquor stores?

**Bret** 46:31

Well, of course. This has me thinking about something else, though, which is that I'm seeing now a lot of people talking the CDC is now talking about make your own mask there bother lots of instructions out there. I don't know why it took people so long. It was obvious from the very beginning that to the extent that anybody was saying masks don't work, that they were telling you that they either didn't understand or weren't being honest, it couldn't possibly be true that they don't work at all,

**Heather** 47:02

well, or they or the argument actually was, we know there's not enough, we don't have the capacity to make more, we need them saved for the health professionals who need them more than you do. Yeah. But instead of telling you the truth, that you should cover your face, but you should not buy or hoard these, because we need them for someone else. We got fed a overly simplistic and frankly, wrong message that they don't work. Yeah, but serves no one

**Bret** 47:30

that's covered by they're either uninformed, or they're lying, that's lying. And the fact is, that's not just lying, that's lying that kills. So I have no sympathy for anybody who fed us some kind of garbage message in order to preserve those Master, the health care professionals, I would far prefer that they had said, Look, somehow we got caught off guard, we don't have enough of these things, they're very nature is that they are disposable, we can preserve them a little bit, but they're not going to be enough. So let's do a crash course on how you can make your own mask and protect yourself. So that's on the professional side, on the side of the public. I have to say, and I'll say this as gently as I can. But I believe that we have a crisis when it comes to extrapolation, that people have lived in circumstances where they're so used to having what they need delivered to them, that they have, in some sense, forgotten what to do, when nobody shows up to help. And I'm seeing them bootstrap those capacities. But it's late, you know, weeks late on in the case of the most basic protections that you already have the materials in your house, there's no question about it. So how many people will die, because it took weeks for it to catch on that you could actually make your own mask and that it had some value.

**Heather** 48:55

I'm reminded you saying that of one of the many bullet points that I used to go over with my students before running study abroad trips, and which we did with our students on the final study abroad trip. The first and only one that we ever did together. In 2016. One of the points was, you know, sort of advising people as to whether or not this was really a good fit for them is spending five 811 weeks in sometimes pretty challenging situations, at field stations without regular electricity. But you know, it's really, really quite comfortable compared to how most of the world lives. Is this right for you? One of the things I would say to them was you need to be the sort of person who, when something goes wrong, or when you feel like a problem needs to be addressed. Your first thought is, how can I fix this? If your first thought is Who can I ask? There's a good chance that you're going to be more of a burden than a help here. And so all of us, you know this, you started with saying We have a, we have a crisis of extrapolation, we have a, we have a crisis of self sufficiency as well, people, people need to begin to assume that they can have the tools on board. And if they don't, yet they can develop the tools onboard themselves, to address many of the problems that they are dealing with, on their own. And this is not to say that we aren't deeply social creatures who need other people around us to solve problems. But if your first thought always when encountering a problem is who's going to help me? You are going to be up a creek without a paddle. Which, which is not a good situation to be in?

**Bret** 50:37

No. So the crisis is learned helplessness. Yeah. And unfortunately, it runs pretty deep. I kept thinking, Okay, what if instead of this having been COVID-19, with all its various idiosyncrasies, you'd been somewhere and a dirty bomb had gone off, or somebody had released a weaponized virus in a crowded place? You have a shirt? Would you know that you're supposed to use it? Would you understand that pulling it over, your head is not protective, but it's way better than nothing. And so I also think I'm watching people put out these instruction sets on how to modify your bandana so that you know, has elastic. What the heck is Why are people so focused on a device that you're using for a medical purpose, looking like a medical mask, the fact is, those medical masks are designed the way they are to be disposable. The whole purpose of them is that you have a sacrificial layer that you can dispose of. You're not living in that circumstance, you're living in a circumstance where you have a washing machine, and you don't have the materials to make a high quality disposable mask. And why would you go through the effort? You've got a square of cloth and even if you don't have this, surely you have a bedsheet you're not using you could cut it out a case. Right? And you know, I've seen people have forwarded me this, this paper that says, I'm convinced it's incorrect, because the model they use to test how effective it was, was, I believe, not at all accurate for a situation like a virus that travels, you know, through the air and water molecule water droplets. But even if the worst were true, and this paper right, and a bandana were only 20% effective, that's not really the question. The question is, first of all, let's say it's 20%. Effective, when you're doing nothing you're walking around normally, nobody else is wearing one. How effective does it become, when everybody's wearing, you know, you take the 20% on the intake side, and you take everybody who's coughing has one between them, and the environment, you're going to be way up closer to 80 or 90%. For those two things, and that's before you get to regular hand washing before you get to having a regular cycle where when you get in your car from the place, you've gone to buy your food, you come in and you sanitize your hands before you touch the wheel. So

**Heather** 53:03

the more of these things you do, the safer you are, they're additive. And with each thing that you do, that is that brings less efficacy, there is less value. And so at some point, everyone makes a decision about the limits of their own behavioral modifications. But everyone needs to be washing their hands carefully. Well, every one 100%, probably everyone should be wearing face coverings when they're out. And they know the enemy is the perfect enemy. The perfect is the enemy of the good. So you don't have an in 95 mask, as most people on the streets probably don't at this point, because there aren't enough to go around for the people who really, really, really need them. You wear something, and it gives you an additional boost of protection.

**Bret** 53:47

Yeah, it's a it's, it's very hard to understand what people's psychological orientation is, especially in light of the fact that let's face it, civilization has come as close to a halt as it can. That is an amazing level of shift from normalcy. So simply getting everybody to wear something to block what they may be exhaling is a tiny change compared to nobody's going to work who's not in an essential job. So we're already making all kinds of shifts in order to prevent the spread of this. But to me the most obvious one, which is let's augment the value of whatever masks people are wearing by getting everybody to wear a mask, you know, just as it is now. impolite to shake hands, or stand too close to somebody it should be impolite not to be wearing a mask of some type as you walk around. How much more effective would we be if everybody was doing it? All right. So other matters that we should be covering.

**Heather** 55:02

I think maybe we should sign off, come back in a few minutes and do q&a. All right, that's something more

**Bret** 55:08

No. So there will be a second live stream. The link to that second live stream will be in the description of this live screen stream. You can click it, you can go over there and we will answer Super Chat questions. All right. see you shortly.