

LIVE EVENT Q&A: Dr. Andrew Huberman Question & Answer in Portland, OR

Recently I had the pleasure of hosting two live events, one in Seattle, WA and one in Portland, OR. These events were part of a lecture series called The Brain Body Contract. My favorite part of each evening was the question & answer period, where I had the opportunity to answer questions from the attendees of each event. Included here is the Q&A from our event in Portland, OR.

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- Welcome to the Huberman Lab Podcast, where we discuss science and science based-tools for everyday life. [light music] I'm Andrew Huberman, and I'm a Professor of Neurobiology in Ophthalmology at Stanford School of Medicine. Recently, I had the pleasure of hosting two live events, one in Seattle, Washington, and one in Portland, Oregon, both entitled "The Brain Body Contract," where I discussed science and science-related tools for mental health, physical health and performance. My favorite part of each evening, however, was the question and answer period that followed the lecture. I love the question and answer period because it gives me an opportunity to hear directly from the audience as to what they want to know most, and indeed to get

into a bit of dialogue. So we really clarify what are the underlying mechanisms of particular tools, how best to use the tools for things like focus and sleep. We also touched on some things related to mental health and physical health. It was a delight for me, and I like to think that the audience learned a lot. I know that many of you weren't able to attend those events, but we wanted to make the information available to you. Therefore, what follows this is a recording of the question and answer period from the lecture in Portland, Oregon.

00:01:08 Momentous Supplements, InsideTracker

I hope you'll find it to be both interesting and informative. I'd also like to thank our sponsors of these live events. The first is Momentous Supplements, which is our partner with the "Huberman Lab Podcast," providing supplements that are of the very highest quality that ship international and that are arranged in dosages and single ingredient formulations that make it possible for you to develop the optimal supplement strategy for you. And I'd also like to thank our other sponsor, which is InsideTracker, which provides blood tests and DNA tests

00:01:36 Upcoming Live Events: Los Angeles & New York

so you can monitor your immediate and long-term health progress. I'd also like to announce that there are two new live events scheduled. The first one is going to take place Sunday, October 16th, at The Wiltern Theater in Los Angeles. The other live event will take place Wednesday, November 9th, at the Beacon Theatre in New York City. Tickets to both of those events are now available online at hubermanlab.com/tour. That's hubermanlab.com/tour. I do hope that you learn from and enjoy the recording of the question and answer period that follows this. And last, but certainly not least,

00:02:16 What Are the Current Best Practices for Post-TBIs? Thoughts on Hyperbaric Oxygen Therapy?

thank you for your interest in science. [light music] "What are the current best practices for post TBIs," traumatic brain injuries for those of you that aren't familiar with TBIs, "Especially long term, multiple," ooh, "et cetera." "Thoughts on hyperbaric O?" I'm so

glad you asked this, Danny Morledge, "As treatment for TBIs?" Okay, TBI... Now, one thing about TBI and concussion, everyone thinks football. Guess what? Most of the TBI is not football. There aren't that many football players, they're just large so they stand out. There might be a few here this evening. [audience laughing] Of course, football players are a concern when it comes to TBI. Most head injuries are going to be construction workers. Have you ever seen the hard hats they wear? Those, I don't even know if they are just there for show. It doesn't make sense. And that we actually have a lab at Stanford that's focused very hard on trying to solve this problem. So, construction workers, car accidents, bicycle accidents. Portland, amazing city to cycle; I'm frankly afraid to cycle. You're a small moving object around these big objects and people are staring into their little aperture on their phone while driving. I mean, whatever happened to that by the way, of not texting while driving? Somehow that just disappeared. It's like, it really has just disappeared. There was all this science showing that it's worse than drunk driving. TBI. Well, the basic rules of the "don'ts" apply. If you get a head injury, don't get a second head injury. But that often isn't feasible for people that need to work, continue working in construction, or that are struggling. What do we know? Well, this is a great opportunity for me to distinguish modulatory foundational tools from things that directly change your brain and nervous system the way that you want to. What do I mean by modulatory? We hear so much and there's so many studies showing that great sleep, quality nutrition, good social interactions, avoiding chronic stress, and on and on and on are important for everything; they're related to Alzheimer's, they're related to ADHD. I mean, we could do thousands of podcast episodes just returning to the same 10 things: Sleep, don't stress too much or too long, good social connection, avoid toxic people, eat good food, not too much processed food; We could have an argument all night and I don't want to have one about whether or not it's mainly plants or this. I mean, this is obviously eating high quality food is something that we should all be doing, which foods you select is a topic that is very barbed wire, and I can give only my opinions. All of that modulates your brain function, but it doesn't mediate or change anything directly. It's setting a foundation of what's possible. So we should all be doing those things, and especially people who have TBI. Now, this question relates to hyperbaric chamber. Hyperbaric chamber, there's some very interesting data. It's essentially a hyperoxygenation of the brain for very brief periods of time. I think the data on hyperbaric chamber and TBI are very encouraging. The problem is, much in the way that a few years ago, cryo was only available in a few places. And now people are doing ice

baths and cold showers on their own. It's hard to find a hyperbaric chamber. They aren't just laying around, and they don't have them at spas typically, and they are quite expensive. So, yes, there are interesting and important data I think on hyperbaric chamber. You definitely want to work with a physician or somebody who is very skilled, a practitioner who's very skilled in hyperbaric chamber. They do seem to improve brain function by hyperoxygenating the brain for brief periods of time. It seems to improve a number of things, but above all, it seems to improve the quality and duration of sleep, which indirectly allows the brain to repair itself, because as I mentioned earlier, brain change largely occurs in sleep. So if you don't have access to a hyperbaric chamber, but you do have TBI, what are some of the other data? What do those point to? Well, I'd go on and on, and you don't have to get this from supplements, you can get it from food, but this threshold level of these EPA essential fatty acids. There are now so many data, so much data on the valuable role of these essential EPA fatty acids. Thresholds being somewhere between one and two grams per day of the EPA. So much so, actually, that there are now prescription forms of EPA that doctors are starting to prescribe for people with TBI. Although for most people you can get this through... You can look up and we've done podcast episodes about different ways to access this. Also functions as an antidepressant; equally good, believe it or not, in clinical trials to SSRIs once one gets over the one or basically two grams per day of the EPA. The resident expert on the internet about this is pretty extreme about the dosages, and that's Dr. Rhonda Patrick, who by the way, deserves a nod of acknowledgement and support because it turns out that before me or David Sinclair or Matt Walker or any of these guys were blabbing to the world about stuff that they had learned in the archives of science and in their laboratories, the first person in was this woman named Rhonda Patrick. As far as I know, the first public facing formerly trained scientist to start going on all these podcasts and risk her reputation and this kind of stuff that you deal with when you put your neck out there like that. And Rhonda's, I think, terrific. We don't agree on everything and it would be weird if we did, but I think she's really been the proponent

00:08:03 Are There Effective Ways to Decrease Dopamine When You Get Too Much of It?

of these higher doses of EPAs for TBI and for cognitive function into all ages. "We often hear about ways to increase dopamine. However, are there effective ways to decrease

dopamine when you get too much of it for certain behaviors or habits we want to break?"

Katie Hamm, I think is the last name. Thank you, Katie, for your question. Yeah, dopamine is a slippery slope. And Dr. Anna Lembke is the expert in this, and we've had a lot of conversations. She's one of my closer friends on the faculty. Unfortunately for her, our coffee discussions often last four hours or more. Her poor patients and family. Here's the thing, when dopamine is higher in your brain and body, when you've deployed it through excitement or pharmacology or otherwise, it tends to narrow your focus and make you seek more of it in that general theme that you happen to be focused on. It could be anything. That's the scary thing about dopamine. What can you do to control it and to reduce it? Well, for those of you that are engaging in habits that are healthy, maybe that doesn't require reducing dopamine. How do you define healthy versus unhealthy? Well, I think the simplest way to define addiction, at least by my mind, is that addiction is a progressive narrowing of the things that bring you pleasure. And a good life is a progressive expansion of the things that bring you pleasure. A rather simple definition, and yet when we think about the biology of dopamine, dopamine is not unique to one pursuit. It's not unique to the pursuit of sex or the pursuit of warmth when you're cold or cool environments when you're too warm or food or social media, it's just a dumb molecule that puts you into this forward state of mass, small visual aperture, and a kind of obsessive-like nature. What can you do to counter that? Well, the best thing to do is to not get into that state too long, but if you do, the best thing you can do is to try and switch off that system, not through pharmacology, but by not pursuing more dopamine. The day after a big event, the so-called postpartum depression, named of course because of true postpartum after the delivery of a child. It's quite common for people to get very, very depressed. There's a lot of neurochemical and hormonal adjustments that are occurring, but different types of postpartum depression occur; after a big party, the Monday blues, the Sunday blues, the post-whatever blues. The four month mark in a relationship is typically when dopamine starts to drop. I always tell people, just wait. I'm telling somebody very close to me right now, just wait four months, four months, four months, and also spend as much time with that person as possible. I don't know what this deal is about not spending as much time with people. I think people are afraid that the dopamine wave pool is just going to pull them both under. I think they've called that the escalator model of relationship, where you just sort of find yourself in the relationship because you went through the stages without actually deciding on them. In any event, four months seems to be the stage in which the dopamine crescendo starts to relax a

little bit, not in a long distance relationship, however. We know this, right? Anticipation is dopamine, that positive anticipation, and there's a whole beautiful science of this, and I should say psychology of this. There's a wonderful book actually. The name of the book is embarrassing always, I don't know why, for me to say. It's by a psychologist called "Can Love Last?", which is a psychoanalytic book about this dopamine-serotonin system and the kind of seesawing back and forth. And the fact that in relationships, people often just slam on the dopamine side of things and then they hit a wall and want to break up. Or they go into this like warm, cozy, fuzzy feeling thing, and they go, "Well, I guess the exciting part is over." And this idea that one could actually, or two people or however many people were in Portland could oscillate this seesaw. [audience laughing] I don't think that you want to use pharmacology to turn off the dopamine system, but for people that have a hard time sleeping and that are really in a state of agitation and constantly obsessing, the psychiatrists... One of the oldest and most effective treatments is that the psychiatrists, and this does have to be prescribed, we use a very, very low dose of a dopamine receptor blocker, like Haloperidol, which is used to treat schizophrenia. A very low dose to shut down the obsession component. The smart, well-educated psychiatrists know this as a useful tool, but this is a one time thing with a very low dose because having your dopamine blocked sucks. It does not feel good,. But not being able to sleep and being in an obsessive mode also sucks. So it's actually a very potent clinical tool. So pharmacology is one tool, but really at the far end of things. I believe that one should try and modulate their own dopamine by not rewarding one's self on a regular basis, but only randomly. Random intermittent reward is truly the best schedule of reward, hence slot machines and so on. And you should engage random intermittent reward. And I think this is also the way that we should train kids. I call it training kids. You can tell I don't have kids. [audience laughing] You don't reward them every time. I don't believe everyone should get a trophy every time, nor should you always just reward the winners because those winners often, we see cases of this, high profile cases of this, they often crash and burn. I mean the number of high performers that crash and burn publicly and Lord knows how many do it privately is remarkable. It's 'cause their dopamine system is all messed up.

00:13:50 How and When to Improve Brain Plasticity if You Have 10 Minutes a Day?

So random intermittent reward is the schedule of reward that we should impart on

ourselves. "If you had 10 minutes a day to improve your brain plasticity, what would you do? And when would you do it?" Richard Conlin, thank you. Well, I'm going to say again, I would absolutely anchor my physiology with morning sunlight viewing. I can't help it. Do you know what's interesting? And I'll tell you very briefly, you know what's special about morning sunlight? This low solar angle sunlight. I don't think I've talked about this much on social media or on the podcast. There's a group at the University of Washington, a couple, Jay and Maureen Neitz. They run a lab together. That sounds like a horrible thing, but they do it and they get along very well. And they've discovered that the cells in your eye, the neurons that set your circadian clock make you alert during the day and make you sleepy at night, and so on. Those cells respond best to yellow-blue contrast and orange tones. Now, this is important because when you go out in the morning, even if it's not at sunrise, but it's close to sunrise or you look at the sun in the evening, what you'll see is yellow-blue contrast or orange; yellow, blue, orange, that old thing from kindergarten or first grade. That's not the color of light that you're going to see when the sun is overhead. Now, this also is really interesting because artificial lights, at least to my understanding, even the daylight simulators have not picked up on this. It's just about bright light. Someone ought to design something that can mimic this, but nature has done this beautifully for us. And so viewing low solar angle sunlight in the morning and in the evening is most effective because of those yellow-blue contrasts. Now here's the really wild thing. Those circuits that set your levels of alertness and sleep, yes, they respond best to yellow-blue contrast, but what that tells us is crazy. What that means is that color vision was probably not related to color perception first because all of that is completely subconscious. The pathways that do this are present in people who are pattern vision blind. So, what do I mean? I mean that color vision likely evolved from a need to synchronize your internal state with the external world. And the best stimulus in the outside world to do that is yellow-blue contrast. In other words, our ability to detect color was first and foremost, and we understand this based on evolutionary genomics and so forth, to extract time of day information, not color of fruit or color of skin or anything like that. That's all secondary, which is wild and crazy. And this is yet another example of the way we think things work is not the way they work. It's completely 180 degrees opposite. I'm just going to give you a little teaser. I had a guest on the podcast, we haven't aired the episode yet. His name is Erich Jarvis, he works on speech and language. He also was admitted into Alvin Ailey Dance Company. Again, who are these people? He's a professor at the Rockefeller. Anyway, I learned from Erich, and you'll

learn when that episode comes out, that you only find elaborate speech and language in species that also engage in dance and song. And the genomics point to the fact that song and singing came first and language came second. And that led me during that episode of the podcast, I wrote down in my notes, I was listening to him talk and I wrote down in my notebook, it's just scrawled in big letters. It says, "I am so happy right now." I was just blown away. And it makes so much sense when you hear it, that the colors in the sky were what our system is trying to extract, not a perception of those colors in the sky, 'cause they're informing us about time and orienting us in time. That song and the communication of emotional states would be simpler and more foundational than communication about specific patterns of language. When you hear it, suddenly it makes sense. But of course we're human beings,

00:17:51 How to Use Supplements to Optimize Health When Career Prevents Consistent Routines?

and unless you're Erich Jarvis or Alia Crum or Anna Lembke, you think about all this stuff backwards, as I do. "How can I navigate my way through taking supplements to optimize my health when my career demands, Army infantry, prevent me from being able to establish consistent routines?" Andrew Yagen, well thank you for doing what you do. Andrew, so the consistent routine thing is tough. Here's what I can say without going into a long two and a half hour episode about jet lag and shift work, which we've done. The most powerful way to anchor your brain and body in time is indeed viewing sunlight at consistent times of day. That's not something I made up. We know this based on a lot of work that dates back to the 1930s. The second most powerful stimulus is going to be movement and changes in body temperature. In particular, increases in body temperature tend to make us alert, and decreases in body temperature tend to make us sleepy. Body temperature drops one to three degrees to get us into sleep. Why does a cold shower wake you up? Adrenaline is released and believe it or not, your body is heating up internally to combat that cold, unless you make yourself hypothermic. So, sauna, hot baths to get sleepy, cold showers, ice baths, et cetera to wake up. Sort of obvious when you hear it, but it's counterintuitive because you think, oh, heating up the body to wake up and cooling down the body to go to sleep. So getting into cold ought to cool me down, but your body compensates just like if you threw a cold towel on a thermostat, you'd crank up the temperature in the room and vice versa for heat. Okay, so

what do you do? You want to try and use as many of these things, light, temperature, exercise, food. When you eat is typically associated with waking. Very few of us are capable of eating in our sleep. And then the other one is social activity and rhythms. Now the discombobulated person is going to be the person that has not aligned these things in a consistent way. So while schedules vary, and Andrew, I don't know your exact schedule, what I can say is if you suddenly go from daytime behavior and sleeping at night to the so-called vampire shift, as it's called in the military, and suddenly you're up in the middle of the night and you're sleeping during the day, then when you come off that shift, what you want to do is try and combine as many of those same things at one time. So it would be get your sunlight, so go jogging without your sunglasses, drink your coffee, engage with other people and communicate, eat a meal afterwards or as the case may be before. Try and bring as many of those things together at the same time of day for a few days and pretty soon your system will map around that. So the reason I encourage for those of us that are not doing shift work to try and be fairly consistent about sunlight viewing is it sets in motion everything else that's correct, in terms of timing of eating, appetite will follow, when your alert will follow. You'll start to learn your own rhythms. When you can't control your schedule, try and combine as many of those cues; again, light, temperature, exercise, food, social engagement into one period of time and try and lock that into a more or less a one or two hour period or plus or minus one or two hours at a particular time of day for at least two or three days.

00:21:09 How Is Social Media Changing Our Brains?

And your schedule, meaning your internal clocks will lock to that. "How is social media changing our brains?" Thomas Adcock. Well, you hear all the terrible ways in which it's changing our brains. And I think that again, we go back to this thing, is it the aperture that we're looking at? So is it the format that we're engaging in things? Or is it the content? Well, the way I like to think about the phone is the way that we've been engaging with the phone and the laptop for that matter, in staring into the small visual aperture each day is sort of like walking like this all day long, right? We have this amazing ability to shuffle our feet and take small steps or to take big strides, to run, to move... I think that's the sagittal plane for movement. I know it for the brain, but I always mess it. The PTs are vicious people online, by the way. The PTs and nutrition people, I've learned to just not say anything about that. I'm not a PT and I'm not a physical

therapist. And they do incredible work, but they're like, it's a very spirited crowd. [audience laughing] And the nutrition thing is really weird. I mean, it's just incredible. People are either throwing liver at you or they're throwing celery at you or they're fasting or they're not fasting. It's nuts. In any case, the social media and staring at a small visual aperture is changing our brains. Here's one way I know in which it's changing our brains and then I'll tell you how to fix it. If you stare or look at something within two feet of you for a certain number of hours each day, your eyeball actually gets longer. And the visual image then is focused in front of your neural retina, not onto your neural retina, and you are becoming myopic; nearsighted. And if you look at things in the distance enough, guess what? Your eyeball changes shape and your lens will focus appropriately the image onto your retina. It takes some work. Kids that look at things up close too much, and adults that look at things up close too much become nearsighted. And there's a beautiful set of clinical trials now where mainly in kids, if kids get outside for two hours a day, getting a lot of this UVB and blue light that we're told is so terrible for us, but they get it from sunlight, they actually can reverse myopia, or reduce the incidence of myopia, maybe even glaucoma. Although that's a big maybe. So, how much staring into a small visual aperture is too much? I don't know. But what we do know is that we are literally becoming myopic in terms of our vision and we're becoming myopic in terms of our cognition. And then there's the whole business of what's actually contained in those Tweets and those social media feeds and those news stories. Which frankly, I feel like you lose either way, whether or not you're in one political camp or another political camp, you're upset about half of the information out there. So I feel like, and I'm not someone who knows how to talk about politics without stumbling, I didn't do well in social studies in this sort of thing. It just never made sense to me. It just felt like the prize goes to the person who can shout the loudest and the most coherently for a moment. But I encourage, of course, people to be politically active. And I vote. [audience laughing] But the content is tricky to navigate. And I can't really speak to that, except that it seems to be bothering everybody on one side or the other or in the middle. And the format is something that we really understand. And again, I don't know of many people that are talking about this narrow visual window format thing. It came up more during the lockdowns when we were all inside a lot and not looking out at a distance. The data say really to try and get at least 10 minutes of long distance viewing, so longer than 10 feet away from us, for every 30 minutes of closeup viewing. And not a lot of us are doing that.

00:25:10 What New Piece of Neurological Research Most Excites You?

If you're walking to your car looking at your phone, you're definitely losing an opportunity. "What new piece of neurological research are you most excited about? Mateo Minato. Ooh. I think the piece of neurological research that I... All right, the weird stuff. I've got this colleague at Stanford, Tony Wyss-Coray, and they're really into literally taking proteins from young blood and young spinal cord cerebral spinal fluid and putting it into older people and animals, and they get younger. That stuff's pretty wild. The fecal transplant stuff is pretty wild. You take the microbiome from one person and as it sounds, you transplant it to somebody else and they take on the physical characteristics of the donor. It's crazy. Until I talk to my [chuckling]... There's some shouts for fecal transplant. Nice. [audience laughing] I have never read the method sections of those papers. I'm actually afraid to read the method sections. I would say this is not neurological, but the work from Chris Gardner and Justin Sonnenburg, also at Stanford, it makes it sound like I just like, "Stanford, Stanford, Stanford." But these are the people I'm closest to and surrounded by. There are excellent places everywhere, of course, including OHSU and I'm not just saying that 'cause I'm here. I actually close colleagues here and friends here at OHSU. Also an amazing, although that tram thing freaks me out, it's like I always just have all these ideas about what's going to happen if that thing breaks. But the microbiome data are really interesting. I never understood why getting your gut microbiome was important. And it turns out it's because your gut actually makes many of the neurotransmitter precursors that your brain uses. So that's pretty cool. And I always thought it would be a complicated thing to get your gut microbiome right, but it turns out that it's fermented foods that seem to have the biggest effect. There was all this argument about fiber and yes, fiber is important and here I'm getting nervous talking about nutrition, 'cause the people are going to come at me with fiber. But it's very clear from Justin and Chris's data that people who are getting four servings a day of fermented foods, whether or not it's kimchi or sauerkraut or kombucha, that stuff actually seems to encourage a healthy gut microbiome and people feel better, and their immune system works better. And I like this because it actually, it resolves an issue which is that high dose probiotics, these very expensive need to be refrigerated things, those actually can create brain fog and other issues there for real severe cases of dysbiosis. So I always like an instance where one can look to foods which are good, 'cause I like to eat,

in order to resolve these issues. In terms of other neurologic issues, frankly, I think the stuff on dopamine is fundamentally important. So much addiction, that's a severe case, but also so much waxing and waning of motivation. And once you understand the dopamine system and you say, "What activities am I engaging in or pharmacology am I engaging in? What am I doing to spike dopamine?" You start to go, "Oh, I get it. The waves in this wave pool are too high and that's why I can't do this consistently." And then you do the counterintuitive thing of approaching things with a little less excitement, but then you're able to do them more consistently. It's like, "Ah!" And maybe with some luck, I'll end up finishing this book

00:28:35 Do You Believe in the Wim Hof Method? Does It Work? What's Happening in the Brain?

that I've been working on for four and a half years as a consequence 'cause I can't seem to. "Thinking about the Wim Hof Method. Do you believe it? How is it really working? What process is happening in his brain?" Oh, boy. Madison Cameron and everyone here probably familiar with Wim Hof. Whose occupation on Wikipedia used to be "Daredevil." That was cool. It's like Evel Knievel had it and Wim had it. I got a story about Wim. Actually in 2016, I heard about this guy, Wim Hof, and I got a hold of him, actually his children. And I had one vacation that year and I flew to Spain and I spent some time mountaineering with Wim, which was absolutely terrifying. I almost lost a leg legitimately. I tied in wrong on a bridge sling. He told me it was good for me. He told me to, "Stare into the lizard's eyes." And I stared into the lizard's eyes. I jumped backwards off this homemade bridge sling thing. And I had the rope wrapped through my leg and I came back with basically the tendon on the back of my knee exposed. And sitting next to me on the plane was our Vice Dean of Research at Stanford. And I had to explain to him what I was doing and why. It was very embarrassing. What did we do on that trip? Well, a couple of things that will help me answer your question. First of all, when I arrived, I suffered terribly from jet lag, but the moment I got there, Wim did not say hello. He literally told me to get into the ice bath. And I did 10 minutes in the ice bath not because I'm tough, but because he held me down in the ice bath. He is indeed one of the strongest human beings. He reminds me of the bus driver on "The Simpsons" or the janitor, excuse me. No, Otto is the bus driver, right? The janitor on "The Simpsons," like [grunts] that guy. That's Wim. Incredibly physically strong guy. What do I think's going on

with Wim Hof stuff? Well, Wim Hof, whether or not he understands it or not, I always think he's sort of the Bob Dylan of breathwork. Like everything he says seems to have some intuitive sense, but you don't really understand what in the world he's saying. [audience laughing] He's going to come after me now. We've had a good but complicated relationship, I'll just confess. Maybe someday we'll resolve that. No big scandal or story there, just we communicate very differently. Wim has a couple methods. One is to deliberately hyperventilate. This is also called Tummo breathing. My lab actually studies this. We have a paper that I'm happy to share with you the results although they're not published yet, where people do deliberate cyclic hyperventilation. Which as the name suggests, you just breathe really deeply in and really deeply out 25 times. Or if you're Wim, you'd say, "In and out. In and out." I just tell people, here's how it works. You go [deeply breathing]. You do that 25 times and you heat up and you feel really agitated, and that's because of adrenaline. If you throw yourself into an ice bath or a cold shower, adrenaline. If somebody upsets you or you get a triggering text, adrenaline. Adrenaline sounds like a terrible thing, except when you deliberately induce it. As my colleague, David Spiegel says, "There's a big difference between going into a state and you controlling your entry into a state." So it's not just about the state you're in, it's about how you got there and whether or not you had anything to do with it. States of high adrenaline are very powerful. When you self induce adrenaline by cold shower, cyclic hyperventilation, AKA Wim Hof breathing or Tummo breathing, you then have an opportunity to create a very distinct mind-body relationship. We all hear that interoception and the mind-body relationship. Interoception just your ability to sense your heartbeats and what's going on in your body. Powerful, right? Terrible if how you feel sucks. So interoception is wonderful, but when you're anxious it actually is more adaptive to be able to maintain your thinking and get yourself out of that anxious state. So if you're trembling and your body's freaking out and your cheeks are flushing and your brain is following your bodily state, well, that's not good. And if you're somebody and sadly, this happens a lot where you've experienced a lot of trauma or typically this is people that have been bombarded with extreme criticism or physical abuse or other kinds of abuse during development. They actually can seem very calm, but internally they're freaking out in their head. And they're just thinking, just get me through this. And they just go into a state where no one knows they're upset. I've known people like this and it's eerie to me because I've never had that response to stress, but it's very common. And so we should learn and be careful about deciding that people are in one

state or another based on their bodily or their mental response. Wim Hof breathing, cold showers, et cetera, are a great practice in my opinion, because they allow you to spike your adrenaline. And you can do that, for instance, by making the water colder if you want more adrenaline, staying in longer if you want more adrenaline, moving your limbs around in the water will give you more adrenaline 'cause it breaks up that thermal layer. It makes it a lot colder. Or doing 50 deep inhales and exhales. That is very useful because then you have the opportunity to use that prefrontal cortex and to stop and sense all that adrenaline in your body and yet maintain clarity of mind. And that's an absolutely powerful tool. I would even call it a power tool. And Wim figured this out. I don't know if you know this, but the way that Wim discovered all this was he was in deep grief about the tragic death of his wife. She committed suicide, jumped off an eight story building. Just truly tragic death. And he was in situation, he had four children at the time. Now, he has five. And he was in a state of depression and he ended up going into the canal in Amsterdam and it was very cold and it shocked his system. And in that shock to his system, which is caused by adrenaline, he somehow was able to anchor his thinking and in kind of genius of sorts, Wim thought, "Wow, I can intervene in my physiology with this strange activity." And then he realized that breathing would do it as well. You didn't have to get into cold water. And then, years later, we discovered, not we meaning my lab, but other labs, that when you get into cold water, even just 60 degree water, that there's a very long lasting increase in dopamine. That is 2.5x above baseline, which is on par with some prescription drugs for increasing dopamine. So when people laugh at me and go, "Oh this cold water thing," I get teased a lot on the internet. I've heard on the internet that I eat sticks of butter, which I never said. I said, "I like butter." [audience laughing] I've been told all sorts of things. I've been told I eat sticks of butter. I don't know why. I've been told that I'm dead. That was an interesting one. That was one of the cooler ones. But when I was going out there as a serious scientist and saying, "Using deliberate cold exposure." You can use all sorts of things. Or if you come to my lab, I'd be happy to put you in VR and expose you to all sorts of scary stuff. Or we can inject you with adrenaline or you can inject yourself with adrenaline and titrate that, adjust the levels of that. So it's a very powerful tool. And I think that Wim and others deserve credit for really tapping into that. And as a last point, there's a beautiful study in the Proceedings of the National Academy of Sciences years ago using this deliberate cyclic hyperventilation thing; 25 breath [deeply breathing]. And then another group meditates. And then they inject them both with E. coli. And the people injected with E. coli who

meditate get nauseous, vomit, diarrhea, and they get a fever. And the people who [deeply breathing] first, far fewer symptoms, if any. Why? Because adrenaline actually suppresses a lot of these innate immune responses in a way that's healthy in the short term. This is why you can work, work, work, work, work, where you can study for finals, or you can take care of a loved one and then you finally stop and rest and go on vacation, and then you get sick. Stress activates your nervous system and in doing so, it activates your immune system. Makes perfect sense when you think about it. How would we ever go through famine if you're just getting flus whenever you're stressed? We can deal with a lot. My suggestion is if you're coming off a period of high stress, to do some sort of adrenaline spiking behavior as you taper out of that stressful period,

00:37:08 Can Red Light Therapy Help Treat Exercise Intolerance and Fatigue in Mitochondrial Disease?

not going strictly to massage, vacation, and yoga nidra all day long, as I would reflexively do. "Can red light therapy help treat exercise intolerance and fatigue in mitochondrial disease?" Allison, I'm glad you brought this up. This is another case where I thought, "Oh no, this red light stuff is crazy." And then I went into the literature and it turns out that in 1908, the Nobel Prize was actually given for phototherapy. So, there we go again. And I have this slide, I chose not to use slides tonight, but I have this slide that shows Ken Kesey and the magic bus and stuff from the 1930s, and psychedelics and people getting into cold water. And then here we are, 2019, 2020, you've got Wim Hof, and Matt Johnson giving people macro doses of psilocybin. We're right back where we were. And one of my major goals is to really try and create some scientific discussion around these things. This stuff is crazy on the face of it, but there are mechanisms that are real that underlie it. Red light, because it's long wavelength light, longer literally as opposed to a short wavelength light, can penetrate through things like skin and can indeed change mitochondria. One of the more impressive results on red light comes from my good friend, Glen Jeffery's Lab at the University College London. I've known Glen for years, and a few years, he was a basic vision scientist. And a few years ago he started using red light. He'd have people look at red light at a distance of about two feet in the morning. So is long wavelength light. And sometimes even just take a flashlight, a torch as they call it in England, and cover it with a red film. And they would look at this stuff for a few minutes each morning, and it can reverse some forms of age-related vision loss

and macular degeneration. How we now know it can prove mitochondrial function in photoreceptors by reducing what are called reactive oxygen species. Here's what's interesting, it only seems to work in people older than 40, and it seems to only work if you do it within the first three hours of waking. And the incredible thing is you can do this for one or two minutes a week, and some of the positive effects last as long as three weeks. And it's affecting a very specific form of visual improvement, which is acuity, kind of fine detail stuff in a particular wavelength. So, particular colors and objects and things. Pretty impressive. So, yes, red light can improve mitochondrial function to the photo receptors. If you are going to try and do this stuff, don't put it too close. I don't have any affiliation to any red light panel company. So I can't say anything there. They are rather expensive. Nowadays, people are putting red light everywhere, and I do mean everywhere. People are putting red light on their stomach for improving ovarian function, whether or not it can penetrate isn't clear to me all the way down there. People are trying to do this. I have a friend, I won't name him. Recently, he told me he is really into the red light therapy. He's putting it on his testicles to try and increase testosterone. But he told me that after he handed me the red light. [audience laughing] True story. My team knows who this is. It's no one on my team. Thank goodness. I was like, "Oh, that's super interesting." I actually don't think you want to contact the red lights directly to your skin. So red light is powerful. I don't think we have, aside from the vision protocol, I don't think that it's clear which protocols are best. I will say if you're into red light infrared sauna. Typically those don't get hot enough. Typically if you want to get the benefits of sauna, you want to get between 80 and 100 degrees Celsius,

00:40:39 Is It Possible to Over Do Ice Baths?

which is 176 to 210 or 208 Fahrenheit. And I don't actually do the conversion in my head. I memorize it. "You mentioned the consequences of blasting your brain with too much dopamine. Is it possible to overdo ice baths while following the same line of thinking? Will you experience an extreme low in dopamine with too many ice baths?" Lucas Ancke, thank you for the question. Any behavior that spikes adrenaline, you will eventually get better at tolerating it. You will become cold adapted and you'll become comfortable at high adrenaline states. And you just have to ask yourself this, it's just like lifting weights in the gym or running. You need to leave some space for improvement. So if you run, as people do, and you do your 5k, then you're 10k, then you're half marathon,

maybe a 10k is a half marathon. I don't know. But anyway, then you're doing your marathon. Then you're doing ultras that are 50 miles and 100 miles. I mean, eventually you're going to start doing damage, right? And eventually you look at every ultra runner and typically these are people who are very much on the dopamine pursuit system. I mean, I don't think that he would mind; my good friend and a podcaster who I have tremendous respect for is Rich Roll, amazing human being, and also has an amazing story about addiction. He was an alcoholic. And I'm not sharing anything that he hasn't already shared in his amazing book, "Finding Ultra." He got really into running, running, running all the time and there's a dopamine history there for him. Some of us can use ice baths so consistently and making it so cold and doing them longer and longer that indeed you're playing with the dopamine system. Is it bad? Well, it depends on what you're trading that in for, at the expense of what? Is it giving up cocaine? Yeah, great, stick with the ice bath. But you know, can only make it so cold and you can only stay in there so long before you become Wim Hof, right? And it worked out for Wim, but there's really only one Wim Hof. And in general, that speaks to a larger theme, which is I love the idea of people using tools and understanding mechanism. I mean, of course I love that. It's what I talk about and think about so much in my life. But for most of us, we don't make a living doing those things. And so I do think that the ideal situation is to have behaviors and tools that you intersperse throughout your day and throughout the week. For instance, I think three times a week is fine for the ice bath. No one said you had to do it every day, but you should see sunlight every morning if you can. Just because if you miss a day, your system will be fine, just spend twice as long outside the next day. Seriously, 'cause it's a slow integrating system. But for most of these high intensity things, the less often you do them, the more powerful they are. In fact, if you get into a very hot sauna for four 30 minute sessions on one day. So you go 30 minutes, get out for five minutes. 30 minutes, get out for five minutes. 30 minutes, get out for five. Two hours a day in the sauna, that's a lot of sauna, but the growth hormone release from that type of protocol is a 16x increase in growth hormone. This has been measured in humans. Whereas if you do it every day or three or four times a week, you get diminishing returns on that. So I actually am a big fan of doing really intense stuff only every once in a while. This is also why I only take one long run per week or one long hike. First of all, I don't have time for it. I'm not an ultra runner. I got other things to do. And second of all, it's a strong stimulus. I'm sore until Tuesday, or I don't want to run until Tuesday anyway. I actually think that's fine. And I actually encourage kind of more

healthy, rational schedules of these kinds of behaviors. There's no rule that says you have to do something every day, even if you're trying to engage neuroplasticity. You can learn French or an instrument by practicing three times a week. As long as your practice is very focused, right? Daily perhaps would be better, but very few of us have the opportunity to do things every day consistently. And I really want to encourage a more balanced approach. "Before working for Thrasher, what's the best..." Oh, goodness gracious. The skateboarders are always in the house. My first non-biological family was a skateboarding community. When I have great relationship with my parents now, but because there was a time when there was no one to go to soccer games or do any of that stuff, the skateboard community took me in 'cause there were no parents involved. It was great. There were no referees or coaches 'cause I didn't like authority and it was awesome. And there was no nutritional plan. You drank your slurpy and you sat on the curb, and it was fantastic. I don't do that anymore. But the skateboarding community's one that I've remained close with. I did write for Thrasher under a different name while I was a postdoc to make some extra cash. You won't find those articles anywhere, I hope. They're not very good. And the best skate trick? Well, I was involved in it enough that this will only makes sense like three people in the audience, but I had decent heel flip. I could nollie better than I could ollie. And I was never very good. Oh, there's more skateboarders in the audience. What I will say though, is you have to be very careful with skateboarders, 'cause I don't want to claim that I was any good. Any success that I had was out of sympathy of others for letting me hang around. It's a great community. And it gave me great appreciation for indeed communities of kids that don't have structure and sports leagues and teams and all that kind of stuff. Nowadays, it's actually a much different landscape. And I have to also say that it's really amazing to see all the incredible girls and women skateboarders also. There were none. It's an Olympic sport now for women and girls,

00:46:10 What Are Your Favorite Brain Hacks for Doing Hard Things?

and it's an Olympic sport for boys of men too. So, it's awesome to see that community. Okay, "What are your favorite brain hacks for doing hard things? Ranging from cold exposure to getting through selection?" Hobby Darling, thanks for the question. Yeah, hard things. Well, I'll be honest. I learned how to hack into my adrenaline system a long time ago through the worst possible mechanism, which is that I would set up battles in

my mind. I would get into competition with people, imagined or real, or I would get into states of fearing shame and screwing up. So, this is what a lot of people do I think, you end up scaring yourself into trying to do the hard thing, and it works. The problem is it feels rather like a downward spiral because those negative states of mind work to liberate adrenaline and get you through hard things. So being a kind of rebellious kid, resistance was... If someone told me I couldn't do something, I was like, "Yeah, try me" and this kind of thing. And as I mentioned before, I wasn't crazy about authority. And so, that was the method for a long time. And then, I started reading Oliver Sacks's books and I started learning from people who seemed to access things through this whole love thing. And I tried that love and kindness meditation thing, and that didn't work. And what I started doing was I actually, I'll just tell you before I came out here tonight and before I do anything challenging, I just actually like to imagine the people that have supported me. It's a weird tool. I don't think I've ever shared. I'm actually slightly embarrassed to share this out. 'Cause there are only two things that make me cry, and that's talking about my bulldog and talking about my graduate advisor. And if I talk it about any longer, I'll probably cry. But I think about them a lot because they were kind of similar. They were kind of ornery and they were hard on me, and I adored them both. And so these days I try and think about people that really, that I love. And so I have been trying to do this whole, like, doing things from a place of love thing. And so, for me, that's animals and people that I love. And okay, now, I better move on.

00:48:25 What Do You Fear? How Do You Manage Fear?

Ah, thank you. [audience applauding] Okay, they're telling me one more question. So I'm going to answer one more. "What do I fear? How do you manage your fear?" KB, oh, gosh. This is going to turn into a no one's going to be satisfied until I cry. I get it, I get it. [audience laughing] I do cry, but again about the things I mentioned before. I realized something, by the way. We just recorded an episode on grief. It hasn't come out yet. Fascinating topic. I realized at one point, by the way, I'll just give this away, that I thought I was really sad about losing them. I thought I would tear up really easily because I was sad about them. But then I realized that this, gosh, I can't believe I'm going to do this. But I realized that feeling that I was feeling is the exact same feeling of love that I had when they were alive. So, grief is love. And when you look at the literature, it's basically that, but your brain is freaking out because that map of knowing where people are in

space and time, grief is basically a remapping of the space: Where are they? Time: When are they? And then, this kind of abstract map representation that we call closeness. And grief is this process of ripping ourselves off of that. So, in any event, what do I fear? Talking about things like this. What do I fear? Quite honestly, my biggest fear, the thing that would just make me feel just horrible is I fear letting down my friends. I have an amazing... I love my family and they're wonderful, but I have this incredible relationship to friendship, and I adore my friends and I would sooner give up all my limbs and die before I would

00:50:05 Conclusion

deliberately let them down. So, there you go, that's what I fear most. [audience applauding] Thank you. Thank you. I also fear I've gone long. And so my team has shut this down. I just want to just briefly, two things. First of all, I of course want to thank everyone for coming here tonight. I realize it's the middle of the week and to commit some hours of your life to thinking about these brain mechanisms, we got pretty nerdy there for a minute, and hopefully the tools redeemed those who were only interested or mostly interested in practical tools, but hopefully some of the insights about how you work were useful as well. I do want to just make brief mention of the sponsors that made this possible, 'cause they did make this possible. And we made every effort to try and keep the ticket prices manageable for people. And thanks to InsideTracker and Momentous for making this possible. And then, of course I would be completely remiss if I didn't say thank you for your interest in science. [audience applauding] [audience cheering] Thank you. Thank you. Oh, wow, thank you. Thank you. Thank you. Thank you. [light music] Thanks so much. Everyone be sure to get home safely tonight.