

**Huberman Lab #10 - Tools for Managing Stress & Anxiety**

Published - March 8, 2021

Transcribed by - [thepodtranscripts.com](https://thepodtranscripts.com)

## Introduction

Welcome to the Huberman Lab podcast where we discuss science and science-based tools for everyday life. I'm Andrew Huberman and I'm a professor of neurobiology and ophthalmology at Stanford School of Medicine. This podcast is separate from my teaching and research roles at Stanford. It is, however, part of my desire and effort to bring zero cost to consumer information about science and science-related tools to the general public. In keeping with that theme, I'd like to thank the sponsors of today's podcast.

Our first sponsor is InsideTracker. InsideTracker analyzes your blood and DNA to give you an accurate assessment of your health and your biological age. There are many things about our health that can only be analyzed from blood and DNA tests. I've been getting my blood assessed for many years now and about a year ago, I switched to InsideTracker. What I like about InsideTracker is that you get all this information back about metabolic factors, endocrine factors, etc. that are really important to your health. But unlike a lot of blood tests where you just get all the numbers back and it tells you whether or not things are high, normal or low, InsideTracker also has this really useful and really easy to use dashboard that takes the information for your blood and DNA tests and points you toward particular behavioral, nutritional, and other sorts of protocols that you can use to get the numbers where you want them for your health. If you'd like to try InsideTracker, you can go to [insidetracker.com/huberman](https://insidetracker.com/huberman) and they will give you 25% off any of their programs. Again, their programs allow you to assess your health from the inside - things that you could just never assess from any kind of test that didn't involve blood and DNA. And it also has this really interesting feature - that it can measure your inner age, which is based on biology. Your chronological age, of course, is very informative about your health and where you ought to be in terms of health metrics. But people vary. We know people, of course, that are in their late 90s who are doing well. We know people that are in their 50s who are struggling or even in their 20s. So, blood and DNA are the way to analyze your health. That's my belief. That's why I use InsideTracker. So, go to [insidetracker.com/huberman](https://insidetracker.com/huberman) to get 25% off any of their products and use 'huberman' at checkout.

Our second sponsor of today's episode is Helix Sleep. Helix Sleep makes mattresses and pillows that are ideally suited to your needs for the best night's sleep possible. I switched to using a Helix mattress and Helix pillow this last year and I'm sleeping better than I ever have before. The way that Helix mattresses work - and the reason they're different - is that they are tailored to your individual sleep style. Your sleep style can be assessed by going to their website. You take a brief two-minute questionnaire quiz - ask you questions like, "Do you sleep on your back? Or your side? Or your stomach?" Maybe you don't know. Or maybe you move around a lot during the night. It also asks you questions such as, "Do you tend to run hot or wake up cold?" - things of that sort. And then, they tailor a particular mattress to your sleep needs. For me, I matched to the so-called "Dusk" mattress and I love it. I sleep better than ever. And right now, if you want to try Helix Sleep, you can go to [helixsleep.com/huberman](https://helixsleep.com/huberman). And if you do that, you'll get \$200 off your order plus two free pillows. They also have a great warranty. They have a 10-year warranty on their mattresses. If you don't like the mattress for any reason, they'll pick it up for free from your home and they just make the whole

thing really easy to try and determine whether or not it's right for you. So again, it's [helixsleep.com/huberman](https://helixsleep.com/huberman) to get \$200 off and two free pillows on your first order. Some of you have asked how you can help support the podcast in yet other ways besides just checking out our sponsors. We really appreciate the question and we've set up a Patreon account at [patreon.com/andrewhuberman](https://patreon.com/andrewhuberman), which allows you to donate to the podcast at a variety of different levels. We have, for instance, "The 5-HTP" - which is in honor of serotonin - 5-HTP is the name for serotonin - that allows you to donate \$5 per month. We have "The Circadian" - which as many of you, of course, will know is 24 hour day - so, you can donate \$24 a month if you like. You can also pick any value that you want. We even have "The Costello" - which is \$10 a month, which allows you to support the podcast in honor of Costello - the fact that he's 10-years-old, that he eats 10 pounds of food a day, and the fact that he takes 10 one-hour naps per day on average. So again, that's [patreon.com/andrewhuberman](https://patreon.com/andrewhuberman) if you'd like to support the podcast that way.

Today's episode is going to be all about the science of emotions. The first month of the podcast, we talked about sleep and wakefulness. Last month, we were talking about neuroplasticity - the brain's ability to change in response to experience. And this month, we're going to talk about these things that we call emotions. We're going to decipher what they are, how they work, how we can control them, when we might not want to control them. There are going to be four episodes on emotions and today we're going to talk in particular about something that most often is called stress. You might be thinking, "Wait, stress isn't an emotion." But stress really lies at the heart of whether or not our internal experience is matched well or not to our external experience - or the events that are happening to us and around us. And as you'll soon see, those converge or combine to create what we call emotions. Now, I want to be very clear that we're going to talk about the biology of emotions. We're going to talk a little bit about some psychological concepts related to emotion. And we are definitely going to talk about tools to control what we call stress - or commonly think of as stress. We're also going to clean up some common myths about stress. For instance, that stress impairs your immune system. That's true in certain contexts. And in other contexts, stress actually enhances your immune system and makes it function better. There is going to be a lot of discussion about whether or not our internal state - whether or not we are alert or calm - is good or bad depending on the circumstances. So, where we're headed here is I'd like you to come away from today's episode with what I call an organizational logic - a framework for thinking about these things that typically we just call happy, or sad, or depressed, or anxious. And I'm going to make sure that you have tools that are grounded in physiology and neuroscience that will allow you to navigate this otherwise complex space that we call emotions that will allow you to ground yourself better when you're feeling like life is weighing on you or you're kind of being pulled by the currents of life - as well as to support other people - whether or not that's in a psychological practice if you're a practitioner - or you have clients, or children, or spouses - really to be able to support other people in your environment better. And the tools that I'm going to focus on today range from behavioral tools - we will talk about some of the more valuable supplementation tools that are out there and we're going to talk a little bit about things like depression - PTSD. But we will be devoting entire episodes to things like depression, PTSD, and even attention deficit and obsessive compulsive disorder - which believe it or not - although, this might not surprise many of you - have a very strong

emotional component. It's just - not just about compulsive behaviors and intrusive thoughts. It's also about the emotional load of being in that state. So, I promise that today we're going to clean up a lot of misunderstanding. We're going to give you a lot of tools and you're going to learn a lot about the biology of how your body and brain work together. Because if ever there was a topic that brought together the brain and body or mind-body relationship, it's stress and emotions. It's also the positive emotions. When we feel something - whether or not we're super happy - or just feeling kind of pleasant - or we are feeling stressed, anxious, and overwhelmed - it isn't just in our head. It's also in our body. And as you may recall, the nervous system - which includes the brain, and the eyes, and the spinal cord, but also all the connections with the organs of the body - includes the brain and body. And those organs of the body - your gut, and your liver, and your spleen - they are also communicating with the brain. So, I look forward to a day, in fact, when we no longer think about neuroscience as just the brain. And many neuroscientists now also think about the body, of course - and the brain controls the body - but the body is also having a very profound and concrete influence on the brain. I think up until recently, people would hear about - kind of - brain-body and always think about mindfulness. We're actually not going to talk that much about mindfulness at all today. Mindfulness is kind of a vague concept, in fact. When you think about mindfulness, it's good to take the opposite. What's the opposite of mindfulness? It would be mindlessness. Well, all of a sudden we're into territory that isn't really easy for one person to describe their experience or to help others with their experience. Today we're going to talk about objective tools that match the brain-body experience or separate the brain-body experience in ways that leverage your ability to lean into life better, to feel better - literally, to just feel better about what you're experiencing - and believe it or not, to be able to control your emotions when that's appropriate. This isn't about becoming robotic. This isn't about trying not to feel human. This is actually about being able to lean into life better as a consequence of being able to control some of your inner real estate - this nervous system that includes the brain and body and how that nervous system is interacting with the outside world. So, it's to place you in a greater position of power. And so, let's get started in deciphering: What is stress? What are emotions? And why did I batch stress and emotions into one discussion today?

Okay, so what is stress? We hear all the time that stress is bad. We hear people saying they're really stressed out. What is stress? You've all presumably heard the arguments or the framework that stresses this horrible ancient carryover from times in which humans were pursued by animals or other human predators and that whenever we feel what we call stress or feel stressed out, that it's just this unfortunate invasion of something that we no longer need in modern life - that this was designed for when we were being attacked by bears, or tigers, or lions, or whatever it is. And gosh, what an unfortunate thing. And we have so many creature comforts nowadays, but we have not eliminated this stress - almost as if it was like an organ or a system in our body that was bad for us - that were stuck with - just because of the species that we are. But first of all, all species experience stress and I think that it's fair to say - even though I wasn't there - that yes, in fact, throughout our evolutionary history, we were vulnerable to animal attack and other human attacks on a regular basis - up until points where we started developing - you know - weapons, and structures, and fire, and other things that allow us to protect ourselves better from those animals and invaders of

various kinds. But it is entirely naive for us to think that in ancient times - "ancient times" being a kind of loose term for previous time - medieval times - you know - 100 years ago - 1,000 years ago - 10,000 years ago - of course, there were infidelities, right? Partners cheated. People died. In fact, before the advent of phones - which we're going to talk about today - you can imagine that someone might head off on a hunt or to go visit a relative and never come back and you would never know why. That would be very stressful. So, there was psychosocial stress. There was the stress of losing loved ones. There was the stress of cold - of famine. There was the stress - probably - also - of just worry. This idea that - you know - ancient versions of the of humans - 1,000 years ago - 100 years ago - didn't worry - I think that's that is entirely inconsistent with everything we know about the structure of the human brain - 100 years - 1,000 years ago. So, all the problems that we're struggling with existed forever. It's just that stress at its core is a generalized system. It wasn't designed for tiger - tigers attacking us - or people attacking us. It's a system to mobilize other systems in the brain and body. That's what stress really is. It's designed to be generic. And that's the most important thing that I'd like you to understand today is that the system that governs what we call stress is generic. It wasn't designed for one thing and that gives it a certain advantage in taking over our the state of our brain and body, but it also gives you all of us an advantage in controlling it because it's based on hardwired biological mechanisms and there are hardwired biological mechanisms - meaning cells, and chemicals, and pathways, and tissues - that exist in you right now - that require no neuroplasticity - that allow you to put a break on stress. And so, we're going to talk about those. So, you have a system for stress and you have a system for de-stress that are baked into you. They were genetically encoded and they - you were born with them and you still have them now. So, if you're alive and listening, you have the capacity to control your stress. And today, I'm going to talk about ways that you can control your stress - not just by doing some offline practice of meditation, or breathwork, or something like that - but real-time tools - tools that allow you to push back on stress when stress hits in real-time. You know, this is something that my lab works actively on - in developing and testing these tools and evolving these tools - and there are other laboratories that do this as well.

### **Physiology of Stress**

So, let's talk about the stress response. And by doing that, you will understand exactly why the tools I'm going to give you work. For those of you that are saying, "Wait, I just want the tools. Just give me a summary. Trust me, if you understand mechanism, you are going to be in a far better position to incorporate these tools, to teach these tools to others, and to modify them as your life circumstances change. If you'd like the cheat sheet or you just want the one page PDF, eventually we'll get that stuff out to people, but it's really important to understand the underlying mechanism. Okay, so: What is stress? Well, let's just distinguish between stressors - which are the things that stress us out - and stress - which is the psychological and physiological response to stressors. I'm mainly going to talk about stress - which is your response to things. Let's be clear about what we already know - which is that stressors can be psychological or they can be physical, okay? If I put you outside on a cold day without a jacket for a very long time, that is stressful. If I have you prepare for too many exams at once and you can't balance it all with your sleep schedule and your other needs for comfort and well-being - like food, rest, sleep and social connection - that is stressful.

So, stress - and as I mentioned before - is generic. It doesn't distinguish between physical and emotional stress. So, what happens when the stress response hits? Let's talk about the immediate - or what we call the acute - stress response. We could also think of this as a short-term stress. So, you have a collection of neurons. They have a name. It's called the sympathetic chain ganglia and it has nothing to do with sympathy. "Simpa" means together and there's a group of neurons that start right about at your neck and run down to about your navel - a little bit lower - and those are called the sympathetic chain ganglia. You don't need to memorize that name. There will not be a quiz, but it's important to know that in the middle of your body, you have a chain of neurons that when something stresses us out - either in our mind or because something enters our environment and we see something that stresses us out that we don't like - heights, if you're afraid of heights - somebody you dislike walks into the room, etc. - that chain of neurons becomes activated like a bunch of dominoes falling all at once. It's very fast. When that happens, those neurons release a neuromodulator - neurochemical - that I've talked about before on this podcast - called acetylcholine. They release that at various sites within the body. Now, this is important because normally acetylcholine would be used to move muscles. Actually, every time we move a muscle - pick up a cup of coffee, right with a pen, walk down the street - it's spinal neurons connecting to muscle and releasing acetylcholine. So in the brain, it's involved in focus and in muscles, it's involved in making muscles twitch. But if we were stressed, we wouldn't want all our muscles to contract at once because we would just be paralyzed like this - you know - in what - tonic activation as it's called. We wouldn't want that - something called tetanus, believe it or not - because the tetanus toxin will cause that kind of rigor of the entire body. You do not want that. When those neurons are activated, acetylcholine is released, but there's some other neurons. For the aficionados out there, they're called the post-ganglionic neurons. Those ones respond to that acetylcholine and then, they release epinephrine - which is the equivalent to adrenaline. So, we have this system where - very fast, whenever we're stressed, the core of our body - these neurons down the middle of our body - release these chemicals and then, there's adrenaline - or epinephrine - released at particular organs and acts in particular ways. We're going down into the weeds here, so just stay with me because it's going to make a lot of sense and you will appreciate having this knowledge in hand. That epinephrine acts in two different ways. Some things like the muscles of your legs and your heart and other things that need to be active when you're stressed, they have a certain kind of receptor - which is called the beta receptor - and that beta receptor responds to epinephrine and blood vessels dilate. They get bigger and blood rushes in to our legs. The heart rate speeds up. Lots of things happen that get activated. And at the same time, that epinephrine activates other receptors on certain tissues that we don't need - the ones involved in digestion, reproduction, and things of that sort - that are luxuries - for when things are going well - not things to pay attention to when we're stressed - and that binds to other receptors that contract the blood vessels. So basically, the stress response - this is the key phrase here - the stress response - (a) is generic - I said that before - and (b) it basically pushes certain systems to be activated and other systems to not be activated. The stress response is two-pronged. It's a "Yes" for certain things and it's a "No, you may not right now" for other things. That's the key thing to understand about the stress response. That's why your heart speeds up. That's why you feel blood in certain organs and tissues of your body, but not in others. That's why your throat goes dry because it turns out that

when you get stressed, the salivary glands are shut down. There's a lot less blood flow to the neurons that control salivation and so, you're going to start swallowing. You're going to feel like your throat is getting dry. There are a lot of different effects. I'm not going to list them all off, but basically you are activated in ways that support you moving. So, that's the third thing. First of all, it's generic. Second of all, the stress response activates certain things and shuts down other features of our body. And then, it's a sense of agitation that makes you want to move. That's because, fundamentally, the stress response is just this generic thing that says, "Do something." And movement in this case can either be the bias to move in terms of action or it can be the bias to say something. When we are stressed, we are more likely to say something that probably we shouldn't say. We are more likely to move and if you're trying to suppress movement, you'll feel that as a tremor. You're going to feel agitated and that's because it was designed to move you. So, this is important because if you want to control stress, you need to learn how to work with that agitation. I'd like to give you a tool at this point because I think if we go any further with a lot more science, people are going to begin to wonder if this is just going to be a kind of standard university lecture about the stress response. I'm going to give you more science about the stress response, but I want to take what we now already know about the stress response and use that as a framework for thinking about how one might reduce or even eliminate the stress response quickly in real-time should it arise when we don't want it. So, we're taking the podium or we're sitting down at a Zoom call - and all of a sudden we're feeling flushed. We're feeling like our heart is racing. We're feeling a little too alert. We're feeling a little worked up and we want to calm down. As far as I am aware of, the best tools to reduce stress quickly - so-called real-time tools - are going to be tools that have a direct line to the so-called autonomic nervous system. The autonomic nervous system is a name given to the - kind of - general features of alertness or calmness in the body. It's typically - it means "automatic" - although, we do have some control over it - certain so-called levers or entry points. Here's what doesn't work to control stress. Telling yourself to calm down. In fact, that tends to just exacerbate stress. Telling someone else to calm down also tends to exacerbate their stress. If you want to reduce the magnitude of the stress response, the best thing you can do is activate the other system in the body - which is designed for calming and relaxation. And that system is called the parasympathetic nervous system. Because, as I mentioned before, the neurons that control stress run from about your neck to your navel - the parasympathetic neurons - "para" just means near - exist in there - some of the cranial nerves. So, it's - kind of - let - neck and lower brainstem - kind of - back of the brain and in the neck, and in the pelvic area. And the parasympathetic nervous system is really interesting because - especially the cranial nerves - the ones that are up in the brainstem and in the neck area - those have a direct line to various features of your face. In particular, the eyes - they control things like eye movements, pupil dilation - things of that sort - as well as the tongue, the facial muscles, etc. The parasympathetic nervous system - many people don't realize this - is the system by which we control the face and the eyes - and to some extent our airway - the trachea. And it's these neurons that reside within the pelvic area. Now, the neurons within the pelvic area are involved in control of the genitals, the bladder, and the rectum. And those don't have a direct line. You don't have a direct way to control those. It actually has to go from brain to spinal cord and then out to those organs - whereas the parasympathetic nervous system has

certain entry points or what I'll call "levers", right? - that will allow you to push back on the stress response in real-time, and diminish it, and feel more relaxed really quickly.

### **Tool - Physiological Sigh**

So, I'm going to teach you the first tool now - so, I don't overwhelm you with all this academic knowledge without giving you something useful. And the tool that - at least to my knowledge is the fastest and most thoroughly grounded in physiology and neuroscience for calming down in a self-directed way - is what's called the physiological sigh - S-I-G-H. Now some of you might have heard me talk about this on previous podcasts, but I'm going to explain this in the context of how respiration, in general, is used to calm us down. And it turns out, you're all doing this all the time, but you are doing it involuntarily. And when you stress, you tend to forget that you can also activate these systems voluntarily. This is an extremely powerful set of techniques that we know from scientific studies that are being done in my lab, Jack Feldman's lab at UCLA, and others now that are very, very useful for reducing your stress response in real-time. And here's how they work. These days, there seems to be a lot of interest in breathwork. Breathwork typically is when you go and you sit down or you lie down and you deliberately breathe in a particular way for a series of minutes in order to shift your physiology, access some states, and it does have some utility that we're going to talk about. That is not what I'm talking about now. What I'm talking about when I refer to physiological sighs is the very real medical-school-textbook relationship between the brain, the body, and the body as it relates to the breathing apparatus - meaning the diaphragm, and lungs, and the heart. Let's take the hallmark of the stress response: the heart starts beating faster. Blood is shuttled to the big muscles of the body to move - move you away from whatever it is the stressor is - or just make you feel like you need to move or talk - your face goes flushed, etc. Heart rate, many of us feel, is involuntary. Just - kind of - functions - whether or not we're moving fast or moving slow. If you think about it, it's not really purely autonomic because you can speed up your heart rate by running or you can slow it down by slowing down - by - your run. You can move to a walk or lie down. But that's indirect control. There is, however, a way in which you can breathe that directly controls your heart rate through the interactions between the sympathetic and the parasympathetic nervous system. Here's how it works. When you inhale - so, whether or not it's through the nose or through the mouth - this skeletal muscle that's inside your body - called the diaphragm - it moves down. And that's because the lungs expand. The diaphragm moves down. Your heart actually gets a little bit bigger in that expanded space. There's more space for the heart. So, I'm not talking about your emotional heart getting bigger. I'm talking about your actual physical heart getting a little bit bigger. The volume grows. And as a consequence, whatever blood is in there is now at a lower volume or moving a little bit more slowly in that larger volume than it was before you inhaled. Okay, so more space - heart gets bigger - blood moves more slowly - and there's a little group of neurons called the sinoatrial node in the heart that registers - it's - believe it or not, those neurons pay attention to the rate of blood flow through the heart and send a signal up to the brain that blood is moving more slowly through the heart. The brain then sends a signal back to the heart to speed the heart up. So, what this means is if you want your heart to beat faster, inhale longer - Inhale more vigorously than your exhales. Now, there are a variety of ways that one could do that, but it doesn't matter if it's through the nose or through the mouth. If your inhaleds are longer



than your exhales, you're speeding up your heart. If your inhales are more vigorous - so, even if your inhales are shorter than your exhales - you are speeding up your heart rate. Now, the opposite is also true. If you want to slow your heart rate down - so, stress response hits - you want to slow your heart rate down - what you want to do is, again, capitalize on this relationship between the body - meaning the diaphragm and the heart - and the brain. Here's how it works. When you exhale, the diaphragm moves up - which makes the heart a little bit smaller. It actually gets a little more compact. Blood flows more quickly through that compact space - sort of like a - just a pipe getting smaller. The sinoatrial node registers that blood is going more quickly, sends a signal up to the brain, and the parasympathetic nervous system - some neurons in your brainstem - send a signal back to the heart to slow the heart down. So, if you want to calm down quickly, you need to make your exhales longer and/or more vigorous than your inhales. Now, the reason this is so attractive as a tool for controlling stress is that it works in real-time. This doesn't involve a practice that you have to go and sit there and do anything separate from life. And we are going to get to emotions. Emotions and stress happen in real-time. And so, while it's wonderful to have a breathwork practice, or to have the opportunity to get a massage, or sit in a sauna, or do whatever it is that you do in order to set your stress controls in the right direction, having tools that you can reach to in real-time that require no learning - I mean, I had to teach it to you - you had to learn that - but it doesn't require any plasticity to activate these pathways. So if you're feeling stressed - you still need to inhale, of course - but you need to lengthen your exhales.

Now, there's a tool that capitalizes on this in a kind of unique way - a kind of a twist - which is the physiological sigh. The physiological sigh was discovered in the 30s. It's now been explored at the neurobiological level - and mechanistically - in far more detail by Jack Feldman's lab at UCLA - also Mark Krasnow's lab at Stanford. And the physiological sigh is something that humans and animals do anytime they are about to fall asleep. You also do it throughout sleep from time to time when carbon dioxide - which we'll talk about in a moment - builds up too much in your system. And the physiological sigh is something that people naturally start doing when they've been crying and they're trying to recover some air or calm down, when they've been sobbing very hard, or when they are in claustrophobic environments. However, the amazing thing about this thing that we call the diaphragm - the skeletal muscle - is that it's an internal organ that you can control voluntarily - unlike your spleen, or your heart, or your pancreas - where you can't just say, "Oh, I want to make my pancreas turn out a little more insulin right now. I'm just going to do that with my mind directly." You can't do that. You could do that by smelling a really good donut or something, but you can't just do it directly. You can move your diaphragm intentionally, right? You can do it anytime you want, and it'll run in the background if you're not thinking about it. So, this incredible pathway that goes from brain to diaphragm - through what's called the phrenic nerve - P-H-R-E-N-I-C - phrenic. The phrenic nerve innervates the diaphragm. You can control it anytime you want. You can double up your inhales or triple up your inhales. You can exhale more than your inhales - whatever you want to do - such an incredible organ. And the physiological sigh is something that we do spontaneously. But when you're feeling stressed, you can do a double inhale, long exhale.

Now, I just told you a minute ago that if you inhale more than you exhale, you're going to speed the heart rate up - which would promote more stress and activation. Now I'm telling you to do a double inhale, exhale in order to calm down. And the reason is, the double inhale, exhale - which is the physiological sigh - takes advantage of the fact that when we do a double inhale - even if the second inhale is sneaking in just a tiny bit more air - because it's kind of hard to get too deep inhales back to back. You do big deep inhale and then another little one sneaking it in. The little sacs in your lungs - the alveoli of the lungs - your lungs aren't just too big bags, but you've got millions of little sacs throughout the lungs that actually makes the surface area of your lungs as big as a tennis court. It's amazing - if we were to spread that out. Those tend to collapse as we get stressed. And carbon dioxide builds up in our bloodstream and that's one of the reasons we feel agitated as well. So - and it makes us very jittery. I mean - there's some other effects of carbon dioxide I want to get into, but when you do the double inhale, exhale - the double inhale re-inflates those little sacs of the lungs. And then, when you do the long exhale, that long exhale is now much more effective at ridding your body and bloodstream of carbon dioxide - which relaxes you very quickly.

My lab, in collaboration with David Spiegel's lab - David's the associate chair of psychiatry at Stanford - are doing a study right now exploring how physiological sigh and other patterns of breathing - done deliberately - can modulate the stress response and other things related to emotionality. Those work are ongoing. I want to be clear. Those studies aren't done. But it's very clear from working our labs - from working with Jack Feldman's lab and others - that the physiological sigh is the fastest hardwired way for us to eliminate this stressful response in our body quickly - in real-time. And so, I'm excited to give you this tool because I think most people have heard that mindfulness and meditation is good, exercise is good for us, we all need to be getting enough sleep, etc. But life happens. And when you find yourself in a position where you are more alert and activated than you would like to be - regardless of whether or not the stressor is relationship-based, or it's financial, or it's physical, or anything like that - you can look to the physiological sigh because it bypasses a very important feature of how we function - which is that it's very hard to control the mind with the mind - especially when we are in heightened states of activation. We are very alert or very sleepy. It is very hard to use these so-called top-down mechanisms of intention, and gratitude, and all these things that are really powerful tools when we are not super activated and stressed or not super tired. But when we are anywhere in the range of very alert and stressed to very sleepy, physiological sigh are a powerful way of bringing our level of so-called autonomic activation - which just means our level of alertness - down. And so, whether or not it's in line at the bank, or whether or not you're wearing a mask nowadays, or you're not - whatever - I - whatever the conditions may be where you're at and your needs - when you're feeling stressed, the physiological sigh done just 1-3 times - so, it would be double inhale, exhale - double inhale, exhale - maybe just 2 times - will bring down your level of stress very, very fast. And as far as I know, it's the fastest way to accomplish that.

An important note about the physiological sigh or exhale-emphasized breathing for lowering the stress response. Many people worry that their heart rate does not come down fast enough. I want to

tell you, you do not want your heart rate to reduce very fast. There's actually something called the vasovagal response where people will stand up or they'll get up in the middle of the night to use the bathroom and then all of a sudden they'll collapse - they'll faint. That's because the heart rate was reduced too much. Some people will see blood or they'll see something really troubling and stressful and they'll pass out. That's an over-activation - or an acceleration - of the calming response. They're not so stressed that they kind of fall off the cliff of stress. They get so stressed that the rebound mechanism for calming themselves down goes too high, too fast. They calm down too fast and they collapse and faint. And so, be aware that if you're going to use the physiological sigh or exhale-emphasized breathing to calm down, that your heart rate will take about 20-30 seconds to come down to baseline. And you may need to repeat the physiological sigh a few times. So, that's an important note about the use of breathing to control levels of stress.

The other thing is that when you decide to look to the body to control the mind, it does something else that's very powerful. When you are stressed in your mind and body - so, you're feeling really agitated, activated, and worried - and you use a tool like the physiological sigh or exhale-emphasized breathing, you will notice that then your brain in your mind becomes more available when you're feeling very agitated. You will notice that then your brain in your mind becomes more available for controlling the stress response and reacting to it - which is great because the sweet spot in life is to be - provided you're not trying to sleep - is to be alert and calm. And so, that's the idea - is to be alert and calm and to bring you back into that sort of plane of alertness.

For those of you that have trouble sleeping or just relaxing through the day, the physiological sigh can be repeated for 10-15 cycles if you like. Some people find that it actually puts them to sleep. So, if they lie down and they're reading and they do too many of these, that actually can put them to sleep. And what you'll find is that most breathwork protocols - the kind of stuff that's done away from real life - that you set aside time and decide to do quote unquote "breathwork" - most of that works such that if you're doing inhales that are longer and more vigorous than exhales, it tends to be activating and alert you. If you're doing exhales that are longer and more vigorous than the inhales, it tends to put you to sleep. And many of the protocols that are out there from laboratories and that are on - you know - populate the internet and wellness sites and whatnot - if it's exhale-emphasized breathing - oftentimes, has been used as a tool for trying to teach people to fall asleep. Physiological sighs a little different. It's designed to be used in real-time. Just think of it as just - kind of - in your kit of things that you can do as life happens and as you need to react to life. A note about nasal versus mouth breathing. There's a plethora of information out there now because of James Nestor's book, "Breath: The New Science of a Lost Art" - which came out this last year - excellent book. As well as "Jaws", which is from Sandra Kahn, Paul Erlich - with a forward by Jared Diamond and Robert Sapolsky. So, a collection of people from Stanford - Jared Diamond's not at Stanford, but the rest are. And some heavy hitters on that book, which is about the benefits of nasal breathing. And in many cases, nasal breathing is more advantageous than mouth breathing for all sorts of things - cosmetic features of the face, especially in kids, warding off infection, etc. With the physiological sigh, the best way to do it would be double inhale through the nose, exhale

through the mouth. But if you can't and you can only do that through your mouth, just do it through your mouth. If you want to do it all through your nose, do it through your nose. This anchors back to some underlying neurology or neuroscience.

So for those of you that want to know, you have two breathing centers - one that's involved in rhythmic breathing for inhales, followed by exhales, followed by inhales, followed by exhales - the so-called Pre-Bötzinger nucleus - named after a bottle of wine and discovered by Jack Feldman at UCLA. And a nearby nucleus called the parafacial nucleus - also discovered by Jack Feldman at UCLA. And the parafacial nucleus is involved in any time you double up the inhales or double up the exhales. It was designed so that you could breathe while you're speaking, because you can't always go inhale, exhale, inhale, exhale when you're speaking. So, I tell you this not to overwhelm you with knowledge, but just know that when you double up your inhales or you double up your exhales, you are activating this parafacial nucleus. And it has other cool effects. Because it's located near the neurons that control the face, it also has a tendency to relax the jaw. There's some interplay between the neurons that control the speaking stuff and the stuff for your tongue. So, all of a sudden when we do this physiological sigh, we tap into neural circuitry that allows us to speak more clearly, to control the muscles of the face and jaw - maybe that means not saying certain things when we're stressed - and just generally, to relax. And so, this brings us back to the neuroscience of this parasympathetic nervous system - this calming system that's been genetically encoded into us - that we all have - regardless of who our parents are - which is that the neurons that control all this stuff - the face, the eyes, etc. - are all working together. And that's why when we get stressed, it's hard for us to speak, or we tend to jitter, and these kinds of things - just like all the neurons that cause stress in the center of the spinal cord are working together to get our body activated. Okay, a lot of science today. You've now got the physiological sigh as a tool. You know the exhale-emphasized breathing will slow your heart down and inhale-emphasized breathing will speed your heart up.

## **Stress**

So, let's think about something now. Let's think about stress - from not whether or not it's acute or chronic - whether or not it's good for us or bad for us - but on three different timescales because then, we can arrive at what this is all about as it relates to emotions. Because trust me, this has everything to do with emotions and whether or not you're functioning well emotionally or you're not functioning well emotionally - whether or not you're coping or not coping. So, those are typically psychological terms and psychological discussions. We are entering this through the portal of physiology - the stuff of medical textbooks - and we will arrive at the psychology soon. But I really want you to understand the difference between the three kinds of stress on three different timescales - short-term, medium-term, and long-term - and what it's good for and what it's bad for. I think we've all heard that stress is bad for us. We've seen these pictures intended to frighten us and indeed they are frightening. You see the nice really plump brain on the left. It says "healthy" or "control". And then, you see the brain that says "stressed" above it on the right and it's like a withered - where we see that the hippocampus - an area involved in memory is smaller. People that are stressed - we see that the Alzheimer's brain is made worse by stress - that people who have a

predisposition schizophrenia - when they get stressed - higher incidence of schizophrenic episodes. You hear that addicts will relapse when they're stressed. I mean - okay, we get it. And it's very important, but I think we've all heard now so many times that stress is bad.

But in that conversation, unfortunately, it's eclipsed some of the really positive things that stress does for us in the short term. So, stress can be short-term, medium-term, or long-term. Long-term stress is indeed bad for all the reasons I just mentioned and many others. But what's never actually been discussed is what stress is so terrific for - positive for - in the short term. And I think we tend to overlook the important question, which is: What is short term and what is long term? No one ever bothers to tell us: What is chronic? What is acute, right? Is it 5 minutes? Is it 5 days? Is it for the duration of final exams? Or is it for the duration of a senior thesis in college? No one - no one actually draws boundaries around this stuff or even general guidelines. And so, it's become a bit of a mess, frankly, to try and decipher this whole space around stress. So, I'm going to try and clean some of this up for you based on what we know from the scientific data.

### **Short-term Stress**

First of all, acute stress - when the stress response hits, that is good for your immune system. I know that might be a tough pill to swallow, but it's absolutely true. In fact, stress often comes in the form of bacterial or viral infection. And the stress response is, in part, organized to combat bacterial and viral infection. There are pathways from the same brain centers that activate these neurons in your - in your spinal cord to make you feel like you want to move. There are other neurons in your brain that activate things like your spleen - which will deploy killer cells to go out and scavenge for incoming bacteria and viruses and try and eat them up and kill them. So, short-term stress and the release of adrenaline in particular - or epinephrine - same thing - adrenaline/epinephrine - is good for combating infection. And this, to me, is just not discussed enough, so that's why I'm discussing it here. And it relates to a particular tool that many of you ask about, but I don't often get the opportunity to talk about in such an appropriate context. It's not that it's ever inappropriate to talk about, but what I'm about to talk about now is the use of, again, respiration - breathing - to somewhat artificially activate the stress response. And that will accomplish two things, okay? I'll return to medium and long-term stress, but I want to say short-term stress is good because the dilation of the pupils, the changes in the optics of the eyes, the quickening of the heart rate, the sharpening of your cognition, and in fact, that short-term stress brings certain elements of the brain online that allow you to focus. Now, it narrows your focus so you're not good at seeing the so-called big picture, but it narrows your focus. It allows you to do these - what I call - duration-path-outcome types of analysis. It allows you to evaluate your environment - evaluate what you need to do. It primes your whole system for better cognition. It primes your immune system to combat infection. And that all makes sense when you think about the fact that famine, thirst, bacterial infections, viral infections, invaders - all of this stuff - liberates a response in the body that's designed to get you to fight back against whatever stressor that happens to be - psychological, physical, bacterial, viral. Again, the stress response is generic.

## **Tool - Wim Hof / Tummo Breathing**

The tool takes advantage of the fact that when adrenaline is released in the body - from the adrenals - it has the effect of also liberating a lot of these killer cells from the immune organs - in particular, from the spleen but from elsewhere as well - and interactions with the lymphatic system that combat infection. The way this works in the real-world is best captured by a study that can be mapped back to so-called Wim Hof breathing. Now, Wim Hof breathing is so named after the so-called "Iceman" Wim Hof. Wim, of course, being this Dutch - he - I think he has self-titled - daredevil. And indeed, he has many, many Guinness Book of World Records for things like swimming under icebergs and going up Kilimanjaro in his shorts and crossing the desert - you know - without water, etc. - things that are quite dangerous if you don't know what you're doing. And Wim obviously survived - or I'm telling you he survived.

But there are two components to a - sort of - breathing protocol that he developed that was based also on what's called Tummo breathing - T-U-M-M-O. So before Wim, there was Tummo breathing. And many people call this now super-oxygenation breathing - although, the breathwork aficionados will probably say, "Well, it's not super-oxygenation because you're also blowing off a lot of carbon dioxide." What I'm talking about here - regardless of whether or not it's called Wim Hof, Tummo, or super-oxygenation - is rapid deliberate breathing. So, it's deliberate hyperventilation. Why would somebody want to do this? Well, deliberate hyperventilation done for maybe 25 cycles. So: inhale, exhale, inhale, exhale, inhale, exhale. Typically, it's done in through the nose, out through the mouth - although, sometimes it's just through the mouth. If you do that for 15 breaths, 20 breaths, 25 breaths - you will feel very alert. People who have anxiety will feel anxious. They might even have an anxiety attack. However, we need to ask why that kind of breathing feels that way. And it's because that pattern of breathing - rapid movements of the diaphragm - will liberate adrenaline from the adrenals. So, it's the release of adrenaline. I mentioned that Wim is also called "The Iceman". Well, that's because he actually discovered this pattern of breathing - somewhat - and again, it maps back to Tummo breathing by going into cold water. When you go into cold water, that too is a stressor and you liberate adrenaline in response to cold water. So if you get into an ice bath or a cold shower, you will immediately release adrenaline from your adrenals. Now, there are all sorts of things related to this about psychological control and stress thresholds that we'll talk about, but I really want people to understand that when adrenaline is released in the body, you are in a better position to combat infections. And so, whether or not you breathe very quickly in these cycles of 25 breaths - and regardless of what you call it - doesn't matter - adrenaline is released. If you take a cold shower, adrenaline is released. If you go into an ice bath deliberately - and even if you do it non-deliberately - adrenaline is released. You are mimicking the stress response and that adrenaline serves to suppress or combat incoming infections.

And this was beautifully shown in a study that was published in a very fine journal - Proceedings of the National Academy of Sciences - for the US. It's literally called, "Proceedings of the National Academy of USA" to distinguish it from other proceedings of other national academies in other countries. The way the experiment went is that people were injected with endotoxin - or in some cases, they were injected with - with a bacterial wall that mimics infection. It gives you a fever. It

makes you feel nauseous. It makes you feel sick. It is not pleasant. Half of the people did a particular pattern of breathing that looked very much like the pattern of breathing I described a moment ago of doing 25 deep inhales and exhales - followed by an exhale holding their breath - then repeating. 25 inhales - exhales - holding their breath. So, this would look something like this - or if you're listening, it sounds like: "Hmm, ah. Hmm, ah. Hmm, ah." 25-30 times - you'll start feeling heated up. You'll start feeling the adrenaline response. You're liberating adrenaline in your body. Then exhale. Hold your breath for 15 seconds and then repeat. And then, typically after doing three or four rounds of that they would inhale very deeply and hold their breath. Now I want to emphasize, never ever ever do this anywhere near water. People have passed out - so-called shallow-water blackout. People have died. Don't do it in the bathtub. Don't do it in the hot tub. Don't do it before swimming. Please don't do it anywhere near water. Please don't do it at all unless you get clearance to do it from your doctor because there are some pulmonary effects and whatnot. And the breath holds should definitely not be done by anyone that has glaucoma or pressure - you know - concerns for the eyes. But these repeated cycles of breathing that liberated adrenaline allowed the group that did that protocol to essentially experience zero symptoms from the injection of this E. coli - which is remarkable. They had much reduced or no symptoms. They didn't feel feverish. They didn't feel sick. They weren't vomiting - no diarrhea. Which is remarkable, but makes total sense when you think about the fact that the short-term stress response - that what's typically called the acute stress response - is designed to combat all stressors.

In fact, were you to cut yourself very deeply while out on a hike in the woods, the other thing that would happen is that there would be a rapid inflammation response. And we always hear, "Inflammation is bad. Inflammation gives us Alzheimer's. Inflammation is the worst thing." But the swelling is associated - the inflammation is associated with the recruitment of things like macrophages - or microglia if it's a neural tissue. Cells in our brain and body whose job is to act like little ambulances and rush to that site and clean it up. And indeed, the inflammation response looks horrible. It sounds horrible. But it's a great thing in the short term. You want to have that tissue marked as "in trouble" and you want the body and brain to react to it. So, if you're getting peaks in stress from time to time throughout your day or throughout your week, you are in a better position to combat infection. You are in a better position to heal your wounds - physical wounds. Many great things happen in the stress response. Now, of course, the stress response isn't always super intense. Sometimes it's milder. Sometimes it allows us to just focus on something because we have a deadline. That can feel stressful, but that's one of the reasons - you procrastinators out there - people always ask me, "What can be done for procrastination?" What can be done for procrastination is you can understand what's happening - which is that you are self-imposing stress because stress acts like a drug. It is a powerful neutropic. I get asked about neutropics. The most powerful neutropic or smart drug is stress. It's the concern of failure. It's the desire to do well. It's the impending deadline. It's the, "Oh my gosh, I have to do this thing now or I'm going to fail." That is the best neutropic you will ever find. That combined with a good night's sleep - which we'll talk about. But we spent a whole month on sleep, so I don't want to backtrack too much, okay? So, short-term stress - great.

The key is to be able to turn the stress response off when you're done - when you don't want that. In fact, let's just really tamp down the relationship between the short-term or acute stress response and infection. Many of us are familiar with the experience of work, work, work, work, work - or taking care of a loved one - or stress, stress, stress, stress, stress - then we finally relax - maybe we even go on vacation - like, "Oh, now I'm finally going to get the break." And then, we get sick. And that's because the adrenaline response crashed and your immune system crashed with it. So, please understand this. Now, many of you might say, "Well, how long is it? Two hours? Is it three hours?" A lot of you out there that really like specificity. It will vary for everybody. I would just kind of use a rule of thumb. When you are no longer able to achieve good sleep - what good sleep means to you. Please see the episodes on sleep if you want more about tools to sleep. When you are no longer able to achieve good sleep, you are now moving from acute stress to chronic stress. You need to be able to turn the stress response off. If I have one wish - well, I have many wishes for this lifetime - but if I have one wish today that I hope will permeate and spread out there, is this idea that we need - from a young age - but even as adults - and forever - we need to learn how to turn off our stress response. Physiological sigh is one. If we are going to activate our stress response intentionally by ice baths, cold showers, cyclic hyperoxygenated breathing - a.k.a. Tummo breathing or Wim Hof breathing - we also need to learn how to press the brake, okay?

So, let's think about the stress system. It knows how to activate itself. Now we are talking about a way of deliberately activating your stress system in order to combat infection. I do this from time to time. I might feel a tickle in my throat or like I am getting kind of run down. I will do this kind of breathing. I do. I will take 25 or 30 breaths. Exhale - hold my - hold my breath. 25 or 30 breaths again - exhale - hold my breath for about 15 seconds. 25 or 30 breaths again - exhale - hold my breath for 25 or 30 seconds - then, a big inhale and I hold my breath until I feel the impulse to breathe. Again, I feel it's safe for me. I run it by my doctor, so it's fine. You should not do this unless it's right for you. But I do this. Some people like the ice bath. I rarely do the ice bath. Some people like cold showers. I like hot showers. So, I take hot showers, but I do this kind of breathing. Again, they are all having more or less the same effect of increasing adrenaline, which allows you to combat the infection because you are activating the immune response.

### **Medium-term Stress**

Okay, so now let's talk about medium-term stress. Medium-term stress is going to be stress that lasts anywhere from several days to several weeks, okay? We might think of that as long-term stress. There are times in life where we are just dealing with a lot, okay? This particular quarter, I happen to be directing a course. I'm doing the lab. I'm doing this. I enjoy all these things immensely, but I'm kind of near my threshold. I'm at - I'm near the point where any additional thing - like I couldn't log on to a website the other day and it felt like the most intense thing in the world at that moment - and I kind of laughed at myself. Fortunately, I caught it. But that typically wouldn't be my response under conditions where I wasn't pushed to threshold. What is this medium-term stress? What is stress threshold?



Well, stress threshold is actually our ability to cognitively regulate what's going on in our body. So, we've all - hear so much about, "We need to unify our mind and body. We need to be at one with our mind and body." - or whatever. Now, I realize I'm kind of poking fun at some of the new-agey language, but the reason I poke fun is not because I don't think it has value, but it has no specificity. What does that mean? I mean - I think I'm always in my body. I've never - fortunately, looked across the room and seen my arm over there or my leg over there. I'm connected to my body. There actually is a syndrome where people feel disconnected from their limbs. This is a real clinical condition. These people actually will seek out amputation. They will try and convince doctors to amputate certain portions of their body. It's a really terrible thing for people to have and it relates to a change in central maps in the brain - believe it or not. Most of us want to keep our limbs - whichever ones we happen to have.

And most of us feel one - in mind and body - so much so that when stress hits, we feel it in our mind and body. A lot of stress inoculation - a lot of managing medium-term stress on the - on the time scale of weeks or maybe even a couple months - so, we're not talking about years of stress - a lot of that has to do with raising our stress threshold. It's about capacity. And there are very simple tools - excellent tools - that will allow us to modulate our capacity for stress. And they look a lot like the tools I just described. They involve placing oneself deliberately into a situation where our adrenaline is increased somewhat - not to the extreme. And then, when we feel flooded with adrenaline - and normally we would panic - it's about cognitively, mentally, emotionally calming ourselves and being comfortable with that response in our body. So, unlike trying to unify the mind and body and make it all calm or make it all alert, this is about dissociating mind and body in a healthy way. And what would this look like? Well, this is something I actually do as a practice because I mentioned before, you can use physiological sighs in real-time. You can use the cyclic hyperoxygenation breathing to combat infection if you're feeling kind of run down. And there's also a way in which you can use things like cold showers or if you exercise and you bring your heart rate up very high - you kind of go into that high-intensity realm where your heart is beating a little bit harder than you're comfortable with - and that you're - or you're - just you feel - some people think it's lactic acid - no one can agree on this - whether what the "burn" is - whether or not it's lactic acid, or it's buildup of hydrogen, or whatever. I don't want to get into that, but we're all familiar with the intense feeling of your muscles kind of burning because you're working very hard physically. The key in those moments is to learn to relax the mind while the body is very activated. And what that tends to do - there's a limited amount of research on this - but what that tends to do is it tends to create a situation where what once felt like a lot feels manageable, okay? You've raised your stress threshold or your stress capacity. One way that you can do this - and this is kind of fun - if it's approved by your physician and you're able to do this, you can bring your heart rate up. You could do this through an ice bath if that's your thing, or a cold shower, or cyclic oxygenation breathing, or you could sprint, or you could go hard on the bike - whatever it is that brings your heart rate up. And then, what you want to do is you want to actually try and calm the mind while your body is in this heightened state of activation.

### **Tool - Dilating Your Gaze**

And the best way that I'm aware to do that, again, goes back to physiology - not psychology. When we are stressed, our pupils dilate. The effect of that pupil dilation is to create tunnel vision. It literally narrows our view of the visual world. We no longer see in panorama. And there's some other effects as well, but that's because the visual system - through this cranial nerve system that I described before - is tethered and is part of this autonomic nervous system. By deliberately dilating your gaze - meaning not moving your head and eyes around - but by deliberately going from tunnel vision to broader panoramic vision - literally seeing more of your environment all at once. You don't have to do what I'm doing - which is not blinking. You're welcome to blink. But it means deliberately dilating your gaze so that you can see yourself in the environment you're in. It creates a calming effect on the mind because it releases a particular circuit in the brainstem that's associated with alertness - a.k.a. stress. Now, this is very powerful. If you're running, for instance, and you're at max capacity - or close to it - or you're kind of hitting like 80-90% of maximum on the bike - and you dilate your gaze, what you'll find is the mind can relax while the body is in full output. And this relates to work that in various communities. People are working with this in the sports community, military communities, etc. But it's a form - not really of stress inoculation - it's more about raising stress threshold so that the body is going to continue to be in a high alertness - high reactivity mode - high output - but the mind is calm. And so, this isn't about unifying mind and body. This is actually about using body to bring up your level of activation, then dissociating - not the clinical dissociation kind of disorders - but dissociating the mental or emotional response from what's going on in your body. And over time - so if you do this - you know - a couple times - you don't have to do this every workout - but if you do this every - maybe once a week or so - you start being comfortable at these higher activation states. What once felt overwhelming and like a lot of work now is manageable. It feels tolerable. So, that's for navigating medium-term stress.

### **Tool - NSDR Protocols / Meditation / Deep Sleep**

Now, there are other tools as well, but we don't want to go over 90 minutes - because 90 minutes is one ultradian cycle. I was trying to keep these podcasts to one ultradian cycle in case you haven't noticed so you can derive maximum benefit from them - based on ultradian cycle principles of learning. So, I don't want to go into every little bit of this and I want to make sure we get to emotions, but I want to emphasize that these medium-term stressors of, "Oh, it's been a hard month..." or "hard week" - or you know - "It's..." - Stanford's on the quarter system - so, "10 weeks" - or "semester" - that is - becomes more manageable when we train ourselves to be calm of mind when our body is activated.

And if you haven't noticed, most of the tools I'm describing today are nothing like the sort of, "Okay, sit and do meditation." I'm not - I'm actively avoiding saying the words "NSDR - non-sleep, deep rest". I talked a lot about those tools during the months on sleep and neuroplasticity and of course, they are wonderful for replenishing your ability to lean into effort, to learn, to focus. Please do try and check out NSDR protocol see if they're right for you. The margins for safety - I think - are enormous. You're basically just listening to a script. We have links to them in previous captions. I've talked to them on various podcasts before. We can provide them again. But today, I'm really talking

about tools so that you can learn to dance with stress to - in the short term, reduce that stress response a little bit if you feel too uncomfortable - in the medium term, to be comfortable at these heightened levels of activation because life is going to continue to come at you. We can't pick the stressors, but we need to be able to function in a higher capacity often. And then, there's long-term stress. Now long-term stress is bad. You do not want adrenaline up in your system for a very long time. In fact, you - you ideally you would have your stress go up various times throughout the day, but it would never stay elevated and it would never prevent you from getting a good night's sleep. Now that isn't realistic, okay? I would say, for me, 3-4 nights out of the month - no matter what I do - I take on too much or something happens and life is life and I don't get the best night's sleep that I would like to get. For many of you, it's 30 nights per month. For some of you, it's 0 nights per month and congratulations to you, 0-nights-per-month people. If you are managing your sleep really well every night, that is fantastic. You really want to be able to fall asleep at night, stay asleep for most of the night and if you get up, go back to sleep for as long as you need to in order to feel rested. That's what I define as a healthy relationship to sleep. Check out the episodes on sleep if you want tools to be able to accomplish that. We can all accomplish that. It can be done and there are tools to do it - zero-cost tools.

### **Long-term Stress**

Okay, so let's talk about long-term stress. Earlier I talked about how breathing can modulate heart rate through this loop that includes the brain and the parasympathetic nervous system. I don't think I mentioned this - and I want to make sure that I mention - that breathing controlling heart rate through the sympathetic and parasympathetic nervous system is the basis of what's called HRV - heart rate variability. And we know that heart rate variability is good. You don't want your heart rate chronically elevated or chronically low. A lot of people think, "Oh, I want a really nice, low heart rate." And indeed, if you're in shape, the stroke volume of your heart will be greater and you can have a nice - you know - slow heart rate. Years ago when I was running regularly, I think my heart rate was down to like 50, or 60, or something like that. That's great. And now, it's higher than that because I'm running a little bit less, but everyone needs to determine what's right for them. But you don't really want your heart rate to be chronically low or chronically high. Both are bad. We know that chronic stress - elevated stress - and especially in the so-called type-A personalities, creates heart disease - leading killer of - for - in most every country, but in particular, in the U.S. Because of the way that adrenaline impacts those blood vessels of constricting and some and dilating others, it's just that kind of hypertension - chronic hypertension - is just bad. And so, chronic stress truly is bad. I want to really make that clear because I - I emphasized a lot of what - some of the positive effects of stress, but you want to be able to tamp down your stress in real-time. You also want to be able to modulate your stress and your emotional relationship to stress in the body in the medium term. But by no means do you want to be stressed out all the time - chronically - for months, and months, and months - and years on end.

### **Tool - Social Connections**

The best tools - the best mechanisms that we know - to modulate long-term stress might surprise you a little bit. First of all, there are going to be the things that don't surprise you - which is

everyone knows getting regular exercise, getting good sleep, using real-time tools to try and tamp down the stress response, etc. That's all going to be really useful. The data really point to the fact that social connection and certain types of social connection in particular are what are going to mitigate or reduce long-term stress. And this is a particularly important issue nowadays where we have all these proxies or surrogates for social connection. We're online and texting with people a lot so we can feel connected. People are like - the planes about to take off and everyone's texting each other - you know - whether or not they have fear of flying or not, they're like, "Okay, see you. Love you. Hate you." - whatever it is that they're trying to communicate to people. Then, plane lands. Every phone's out. "See you. Love you. Hate you." Let's hope it's fewer "Hate you's". But everyone has this kind of need to stay connected to one another. Humans are incredibly social creatures. Now, there is a way to look at this whole business of social connection - not from just the wishy-washy new-agey perspective. I want to point out that sometimes I'll say "wishy-washy new-agey". I have nothing against that. I just - I - my goal here is always to put scientific data and some neurochemistry on things so that - for those of you that are into wishy-washy new-agey stuff, you also can arm yourself with some arguments - for those of you - the members of your family in your - in your life that maybe aren't so tuned into the typical language around those practices. Like, "Oh, connection is really key. We all get oxytocin." Actually, did you know that connection between individuals rarely causes the release of oxytocin? Oxytocin is released in very particular circumstances like post-orgasm, baby and mother, milk let-down. It's associated with - kind of - really intense - kinds of - pair bonding things of mother and child - also father and child - but especially mother and child because its relationship to the lactation system. Couples post-sex - these kinds of things that reflect deep layers of our biology and oxytocin is not just released when we walk in and pat the dog on the head or we see somebody and we give him a hug. "Hey, great to see you." - you know - fist bump. That's not a situation for oxytocin.

## **Serotonin**

The way to think about social connection and how it can mitigate some of the long-term effects of stress is really through the systems of neuromodulation - like serotonin - and through blocking certain things that are really bad for us when we feel socially isolated - things like tachykinin. Let me explain what these are. Serotonin, again, is a neuromodulator. Neuromodulators are a little bit like playlists in the brain. They tend to amplify or bias the likelihood that certain brain circuits and body circuits are going to be activated and that others will not. Serotonin, generally - and I realize I'm speaking very generally here - but it generally gives us feelings of well-being. At very high levels, it makes us feel blissed. And it tends to make us feel like we have enough in our immediate environment. This is why some of the side effects of antidepressants that elevate serotonin - and actually can help a lot of people with depressive symptoms - but the side effects associated with drugs that increase serotonin tend to be reduced affect. They tend to - kind of - blunt affect or make people feel like their libido is lower. Desire goes down because the body has so much serotonin and the brain has so much serotonin that one feels like they have enough. But serotonin - pharmacology aside - or taking antidepressants aside - topic for another time - serotonin tends to make us feel good. When we see somebody that we recognize and trust, serotonin is released in the brain. And that has certain positive effects on the immune system and on other systems of

neural repair, and synapses, and things that really reinforce connections in the brain and prevent that long-term withering of connections. So, serotonin is tied to social connection. Now, social connection can take many forms. As many of you know, I am very attached to my dog. I hope he's attached to me. He's asleep most of the time, so I don't know. And even if he was awake, I don't really know what I would ask him. But he seems more or less to be attached to me as well. And there's no scientific evidence that it has to be human-human attachment. I do have attachments to humans as well. But you can have attachments to other people. Some of those can be romantic attachments. They also could be familial attachments that are non-romantic - friendship, pets - even attachments to things that just delight us. One of the things that really can mitigate against the long-term negative effects of chronic long-term stress isn't just having fun. We hear all this stuff. "You need to play and have fun." That can be a little bit of a tough concept - especially for the hard-driving people or people that are stressed. But having a sense of delight - a sense of really enjoying something that you see and engage in - witness or participate in - that is associated with the serotonin system. And certainly, play is one of those things. Social connection of various forms - those are things to invest in. Some people might say, "Well, nobody wants to be my friend or nobody wants to engage socially anymore."

I'll be the first to admit. Social connection, and friendship, and relationships of all kinds - to animals, or humans, or inanimate objects - takes work. It takes investment. It takes time in not needing everything to be exactly the way you want it to be. I - I have a friend who struggles with this. And oftentimes, the conversations just circle back to the fact that when you want social connection, you often have to be more flexible. You have to eat on other people's schedules. Sometimes you have to eat things you don't necessarily want to eat the most in that moment, or stay up a little later, or wake up a little earlier. Social connection is something that we work for, but it is incredibly powerful.

I want to, of course, tip my hat to - it's only appropriate to call him the great Robert Sapolsky - my - my colleague - who I'm fortunate enough to know - at Stanford - of course, has talked about this quite a lot - so, I want to acknowledge Robert's incredible work and discussions around this. You can look up those materials online and his wonderful books. But primates - and we are primates - we're - we're social species. And as Robert has said many times before, never before in any primate history - but particularly in human history - have we interacted with so many strangers at a distance when we are not really connected to them. So, finding just a few people - even one, or an animal, or something that you delight in - believe it or not - has very positive effects on mitigating this long-term stress on improving various aspects of our life as it relates to stress and emotionality. So, that's the social connection part.

### **Tachykinin**

The other thing is that social isolation that goes too long is associated in everything from flies - believe it or not - to mice and humans - with this molecule, tachykinin. Tachykinin is a molecule that makes us more fearful, paranoid, and impairs our immune system. And so, tachykinin is like this punishment - internal punishment signal. It's like our body and our brain telling us, "You're not

spending enough time with people that you really trust. You're not spending time doing things that you really enjoy." And I often think about tachykinin for myself because I'm pretty hard-driving. I have a lot of pursuits. I also have a lot of wonderful people and an incredibly wonderful bulldog in my life. But there are times when I can be so goal-directed and so in-motion and trying to accomplish everything that I sometimes forget that - about tachykinin. And I like to remind myself - so much so that I actually have a little Post-it above my desk. It says "tachykinin". To remind me, that tachykinin is this very sinister molecule that starts being secreted when we are not socially connected enough. And this is why long meals with friends or family - where they're - we'll talk about phones in a moment - but where there's no intrusions - or even if there are, just feeling like we are connected suppresses tachykinin. And tachykinin is something you really want to avoid because chronic isolation - chronically high tachykinin that's associated with long-term stress - really depletes so many good functions of our brain and body and promote so many bad ones - including irritability, paranoia, fear, etc. That is really something to avoid. And so, I want to highlight tachykinin as something to avoid. I don't want to completely disregard oxytocin. It's just that oxytocin has been built up a lot in the media. And really, serotonin works on much faster timescales. Now, how do you know if you're making serotonin? You don't know in the moment, but you can learn if you pay attention to - kind of - recognize these feelings of comfort, trust, bliss, delight. And those are not weak terms. Those are not associated just with psychological terms. They are - they are every bit as physiological as the movement of your muscles or the secretion of adrenaline.

### **Tool - Gratitude**

And many people focus now on gratitude. You know, gratitude is a little bit subjective - and here, we're moving from some objective to - kind of - subjective things. But recognizing and, in particular, writing down things that you're thankful for - however small they may seem - does seem to have a positive effect on the serotonin system.

### **Tool - Melatonin, L-theanine, Ashwagandha**

Now, there are a plethora of things that will also impact well-being and allow you to modulate your long-term stress - reduce the likelihood that you'll engage in long-term stress. And we don't have time to go into all these. But, of course, finding the diet and nutrition that's right for you - the exercise schedule that's right for you - the sleep schedule - all that. But do not underemphasize the social connection part - please.

As well, there are some compounds that are not antidepressants - although, if you need antidepressants and a clinician prescribes them to you, please follow their advice - if that's what's right for you. There are compounds that are not prescription compounds that can modulate the stress system. And sometimes because of the way that life is, we just don't have the opportunity to control life and to control our response to stress. And at least for myself - I can only talk about my own experience - I've found it useful in times of chronic stress, to start modulating some of the neurochemistry related to the stress response in order to help. Now, if a doctor prescribes you prednisone - or prescribes you some other hormone or something - that's important. But what I'm

talking about now are nonprescription things. You should check out [examine.com](http://examine.com) - this free website - which will allow you to put in any supplement and evaluate that supplement with. They provide links in the so-called human effect matrix to PubMed. It tells you the exact subjects they were done in. Was a postmenopausal women? Was it kids? Was it normal adults? Was it people with autism? Etc. Check out that site for any and all supplements you're considering or taking. I highly recommend it. I have no relationship to them. I just think it's a wonderful site that's curated all this important information. But the - some of these compounds are effective enough. They can kind of take the edge off and I'll use them periodically myself. And so, I just thought I'd mention them since there are a number of you that are interested in them. The three I want to focus on - and one that I think you need to be cautious about - that I've mentioned before - include ashwagandha - funny name - but that's what it's called - L-theanine - or theanine, it's often called - and melatonin.

### **Melatonin**

Let's talk about melatonin first. Melatonin I talked about during the month on sleep. Melatonin is a hormone secreted from the pineal - in direct relationship to how much darkness you are in - not emotional darkness. But light suppresses melatonin. Melatonin helps you fall asleep. It doesn't help you stay asleep. I personally do not recommend supplementing melatonin because it's supplemented typically at very high levels - you know - 1-3 milligrams or even more. That is an outrageously high dose. It's super, super physiological compared to what you normally would make. It also has a number of potentially negative effects on the reproductive axis and - and hormones there. Some people can take it without problems. If you like it and that's your thing, fine. I just want to cue you to the fact that there can be issues. You should check on [examine.com](http://examine.com) - talk to your doctor - especially in kids because melatonin suppresses the puberty response in a number of species. Enough about the negative things of melatonin except that people who take too much melatonin chronically, often times - when they're taking it to sleep or for whatever reason - yes, it can reduce anxiety and stress - but it also can reduce the output of the adrenals to the point where it can become problematic.

### **Adrenal Burnout Myth**

Now, a note about adrenal burnout. There is actually no such thing as adrenal burnout under normal conditions. The adrenals have enough adrenaline to support 200 years of stress - for better or for worse. The concept of adrenal burnout has origins in the work of Nobel Prize winner Hans Selye - who actually discovered what he called the general adaptation syndrome. He discovered a lot of things about stress. He did some phenomenal work that turned out to be true - that we have stressors. There's something called distress. He talked about eustress - which is positive stress. Eustress has never really caught on in the - in the - kind of - more general discussion. But he had this theory that if stress went on long enough that you would eventually reach a phase called exhaustion and that turned out to be wrong - although, many of you may feel exhausted after chronic stress. There isn't really a physiological exhaustion that happened. And that eventually got picked up and ran with the general public and they talk about "adrenal burnout". Too much coffee - "adrenal burnout". You hear all this stuff. There is no such thing as "adrenal burnout". The adrenals don't burn out. There is something, however, called adrenal insufficiency syndrome - which is a real

physiological problem where some people have very impaired adrenals and they can't produce adrenaline - and melatonin taken at very high levels for periods of time that are too long can cause suppression of the cortisol and epinephrine release from the adrenals and can create a - kind of - pseudo-adrenal insufficiency syndrome. So, beware melatonin for that reason. Please - I'm trying - I, alone, can't get rid of the phrase "adrenal burnout". I'm not trying to give a hard time to anyone who feels burnt out or exhausted, but it is for other reasons. It is not because the adrenals are burnt out unless you happen to have adrenal insufficiency syndrome. So, I'm not a fan of melatonin for a lot of reasons.

### **L-theanine**

Now, I've mentioned several of the others - L-theanine. I've talked about L-theanine - which provided it's safe for you - can be taken 100 milligrams or 200 milligrams about a 30 minutes or 60 minutes before sleep. It can enhance the transition to sleep and depth of sleep for many people. It increases GABA - this inhibitory neurotransmitter in the brain. It tends to turn off our forebrain a little bit or reduce the activity of our - kind of - thinking systems and ruminating systems - help people fall asleep. That's for sleep, but theanine has also been shown for people that are chronically anxious or chronically stressed to - if you look at the studies. I have a large collection of studies in front of me right now. If you want to see those links - I know if you want those, go to [examine.com](http://examine.com). Put in "theanine". They linked - for instance, it is known to significantly increase relaxation. There are four studies listed there with PubMed links. It is known to have a minor effect on anxiety, but eight studies have shown that - which I think is a fairly large set of studies - some of them in great journals. It also can reduce task completion anxiety - so, anxiety related to task completion - not good for the procrastinators, perhaps - but for those of you that are chronically stressed, it can increase attention a little bit. It can reduce blood pressure a little bit - improve sleep quality, etc. It definitely has a notable effect on stress. Two studies in particular - that it can notably reduce the effects of stress. So, there is a lot there. It also has effects on insomnia - on some blood lipid profiles. And so, go to [examine.com](http://examine.com) and check it out. But this is one reason why I supplement theanine for sleep. But if I am feeling like I have been under a lot of stress and I am not managing my stress very well with the short-term and medium-term tools that I talked about earlier, I might start taking a little bit of theanine - especially in the late afternoon, which is when I tend to start to feel like I haven't gotten enough done and the day is - kind of - carrying on. And so, you can blunt the response to stress a little bit - which is why a lot of companies are now putting theanine into energy drinks.

### **Taurine**

I am not a big fan of most energy drinks. Most of them have taurine - which I know some of you wrote to me and said, "Oh, taurine's great for all these reasons." Taurine also has effects on the microvasculature that at least for me were not good. It caused bursting of microvasculature in my sclera - in my eyes - which is why I am not a fan of any energy drink that has taurine - or taurine generally. But that's just me. You have to decide for you. I'm sure the comments section, there will be a couple taurineistas out there that will say, "But I love taurine." Great, keep the taurine



companies in business, but it's not for me and I'd like people to know that it may or may not be for them.

### **Ashwagandha**

The other supplement that can be very useful is ashwagandha. Ashwagandha is known to lower anxiety and cortisol. There is six - there are - excuse me - six studies that collectively show reductions in cortisol - which is - cortisol is typically associated with waking up in the morning - which is good. That's a healthy brief cortisol bump that goes away - provided you're getting your light at the right time of days - at right - correct times of day - like morning and evening. But you don't want cortisol chronically elevated. That's associated with all the bad stuff about stress. There's a very strong effect of ashwagandha. You can find dosages at [examine.com](http://examine.com). They report in - across six studies - 14.5 to 27.9 reduction in cortisol in otherwise healthy but stressed individuals. Now, I don't know about kids. You have to look at what the - what the bottle - what it says on various supplements. Most things here are being done in adults so please check carefully. But this is great. I mean - the opportunity - for me anyway - to be able to take something that can help me reduce my cortisol so that I don't get some of the long-term effects of stress. And I'm not going to take ashwagandha year-round. I would only do this if I was feeling like I wasn't managing my short and medium-term stress well. So, I don't take it on a regular basis. I do take it when I'm in these times when things are particularly stressful. It has - there are five other studies that show reduced stress. So, that's not cortisol measurements but things like fatigue, cognitive impairment, etc. It does lower total cholesterol - which may or may not be good or bad for you - up to 10%. Some people don't want their cholesterol lowered. Some people might. We'll talk about this in a month on hormones but cholesterol is the molecule from which testosterone and estrogen - and cortisol, for that matter - are synthesized. So, you don't want to get your cholesterol so low that then you - they are all sorts of negative effects but you don't want it too high either. Mild effects in good clinical studies on reducing depression - probably associated with the effects on stress and some other things as well. So, ashwagandha is something I use from time to time. It's kind of interesting. L-theanine - I rarely will use those during the daytime except under conditions where I'm feeling chronically stressed. So, check out the human effect matrix on [examine.com](http://examine.com). Again, a phenomenal website. I think - I've sent them a few emails before. That's the only exchanges I've ever had with them. But I just think it's wonderful that they put together this resource. Otherwise, I would be stuck mining PubMed. They've collated the papers from PubMed with links to PubMed - so, terrific resource. So, social connection and some supplementation - of course, diet and exercise - sleep - for long-term stress.

### **Look Ahead - Emotions**

And now, we are finally in a position to talk about what we have set out to do from the beginning - which is spend the month on emotions. It was very important that we discuss stress and we discuss in the context of short, medium, and long-term stress - that we discuss tools for short-term, medium-term, and long-term control. I don't really want to say mitigation of stress. Stress is going to happen but our ability to modulate and control stress - in real-time - offline - using tools such as respiration - using tools such as dilation of gaze - using tools like social

connection - maybe some supplements - certainly, take care of your sleep, and nutrition, and exercise. Again, tons of resources and information in the sleep episodes. So, you can look there. We will do a month on hormones, on exercise, etc.

But let's talk about emotions because in subsequent episodes, we're going to talk about OCD. We're going to talk about depression. We're going to talk about mania. We're going to be talking about dopamine and all sorts of things. But at the core of emotions is this question: "What is an emotion?" Well, it's complex. There isn't a single brain area for any one of these things that we call emotions. My framework - and I think the modern science - both psychology and neuroscience - is pretty well aligned with what Lisa Feldman Barrett has talked about. Now, Lisa's at Northeastern University. She runs a big lab there. She's a world expert in emotions. She's written two books that are really wonderful. One is "How Emotions are Made" - which was her first book. The second one is "Seven and a Half Lessons About the Brain". It's a wonderful book as well. It came out more recently. I hosted Lisa on an Instagram Live once. Maybe we'll get here - her here - on the podcast, if we're lucky. We don't agree on everything about the neuroscience of emotions, but I subscribe to most everything that I've heard Lisa say. In particular, the fact that emotions are context-dependent, there's a cultural dependence, etc. I look at things mainly through the lens of physiology and neuroscience at - kind of - low-level circuitry. And one way to think about emotions that I think is consistent - and I think Lisa would generally approve - I can't speak for her, but I would hope she would generally approve of this description - is that when our internal state of stress or calm matches the demands on us or is mismatched from the demands on us, we tend to interpret those as good or bad. Let me give you an example. If I am feeling very anxious - very stressed inside and I have a lot to do, that doesn't feel good, but it's really no different than if I'm very tired and I have a lot to do because there's this mismatch. I'm not in the right internal state - my internal state isn't correct, rather - to meet the demands that are being placed upon me. So in both cases - whether I'm too tired or I'm too stressed to do what I need to do - the valence - meaning the value that I assigned to that - is I don't feel good. It's not a good situation and I don't feel good. Now, I might call it stressed. I might call it anxious. I might call it worried. I might call it a number of things, but it's not good. However, when I'm tired and I want to fall asleep, well then I feel good - because that's what the demand is. I need to go to sleep and I'm tired. If I'm wide-awake and I need to fall asleep, then that's not good. And I - then the brain tends to go down the direction of interpreting the situation as a bad one. So, while the discussion around emotions is far more nuanced and more elaborate than this, one way to think about your relationship to emotions is whether or not your internal state is matching the demands that are upon you. So in that way, we don't really place so much value on whether or not we're feeling alert or sleepy. We only place value on whether or not that alertness - whether or not it's full-blown stress or not - or our sleepiness - whether or not we're falling asleep or just a little bit drowsy - whether or not that matches the conditions that we face. And it's a useful framework to have and it's the reason, in part, why I spent this last hour and a half or so talking about stress and how to control stress.

One reason we did that is because I think it's a valuable opportunity to learn some tools and understand stress and really learn how to take control of stress - which I think we could all benefit from doing - regardless of age. The other reason is that when you start to understand that you have this kind of seesaw system in your body - this autonomic nervous system that takes you from alert and calm to stressed to full-blown panic - it has that capacity - or from sleepy and drowsy to passing out tired to - you know - God forbid - let's hope never - but a coma, right? That you're

basically on this seesaw all the time and where you are on that seesaw of alertness or calmness positions you to be in better reaction to the demands that you face - whether or not the thing that you face is a need to fall asleep or to listen quietly and not react - you now know, for instance, that if your job is to take feedback - maybe you're going in for a job evaluation or you're in a relationship where there was a call for a discussion, and somebody needs to talk to you about something, and we need to talk about something. You're going into the thing like, "Goodness, this is going to be rough." Learning to reduce that stress response a little bit so that you are in a position to hear the information better - and remember from a previous episode, if you close your eyes, you'll be able to actually focus on the information better - there's your permission to not look someone directly in the eye while they talk to you if you really want to hear what they have to say - you will be able to modulate that stress response and lean into life better. You will be able to react to things in a more effective way and to not be reactive. And this is really one of the important things to me anyway is that so much of the language around psychology - which I think is a wonderful field - but pop psychology, in particular - is be responsive, not reactive. Well, great. But then, how does one do that? Well, one does that by modulating their short-term stress response in real-time - not by saying, "Hold on. I need to meditate. Hold on, I need a massage. And then, I can have this conversation" - by modulating the reactivity in real-time. How does one, for instance, be mindful? Which is a beautiful concept, but how are you mindful? Well, I don't know. When I'm moving through my day, a lot of times, I'm just trying to get things done. And as soon as I start monitoring and seeing what I'm doing and - kind of - third-personing what I'm doing, it actually takes me out of the effectiveness and experience of what I'm doing. So for me, sometimes that mindfulness - that observer, as they call it - is something that doesn't help me. It actually hinders me. What's important to me is to be able to work and focus and then to be able to disengage - to be able to do a non-sleep, deep rest - or to be able to still fall asleep, even though I've been working hard until 9:30 to put my head down at 10 o'clock and be out cold - sleeping - by 10:02. That's possible if you can learn to - to control this stress response. And to do that, we can't use the mind to control the mind. We need tools. And so, a lot of the people being grumpy, or anxious, or depressed - a lot of that - provided it's not for some underlying neurochemical reason that's chronic - a lot of that comes from being poorly rested, from overworked, from feeling like the world is bearing down on us. And so, rather than take a subjective view of this, I take the view of objective physiology. What can we do that's anchored to these neuronal systems - in our body, in our brain, in our eyes, in our diaphragm, etc. - and look to those as tools - levers - that we can pull on, and push, and maneuver through life in a way where we start to feel like we have some agency. We actually have some real control because we're controlling the internal landscape.

So, I think that ought to set the stage for where we're headed next - which is to talk about all the things that you normally think of when you think of emotions - like happiness, like awe, like joy. And we will get into some of that. But all of that rests firmly on the foundation of this thing we call the autonomic nervous system - this stress modulation - this calming modulation system. And again, whether or not you're activated or you're calm is not good or bad. It depends on the situation. Certainly when you want to fall asleep, being activated isn't good. When you have work to do, being activated is great. So, I hope today you were able to take a slightly different view of this thing that

we call stress - not just see it as evil, but see it as powerful and useful in certain contexts - great for us in certain contexts and problematic in other contexts - and as well, to think about the various tools that I've presented that can allow you to adjust and modulate your internal levels of alertness or calmness so that you can lean more effectively into life - which includes sleep, and social connection, and the work you have to do. And of course, acknowledges that the events in the world are beyond our control. What's in our control is how we react to them - something that's commonly said in the wellness, and self-help, and psychology world - but for which they're often in the world, but for which there often aren't as many concrete tools that we can really look to and trust in real-time. And of course, there are other tools out there. As always, I'll say it. I - I strive to be accurate, but I'll never be exhaustive. I might have exhausted you. I might have cured your insomnia with this discussion today. But in all seriousness, my goal is to bring you tools and information so that you can manage better through life. So, thanks so much.

## **Conclusion**

I very much want to thank all of you for your support for the podcast. It's really been wonderful. If you've subscribed to the podcast on YouTube, Apple, or Spotify - or maybe even all three - terrific. If you haven't, please do subscribe on YouTube, Apple, or Spotify - or maybe even all three - which would be wonderful. On Apple, you can leave a five-star review if you think we deserve that as well as a comment reviewing us. If you have suggestions - if you have questions regarding the content of the podcast or things that you'd like us to cover in the future, please put those in the comment section on YouTube. As well, if you could recommend the podcast to friends, family members, coworkers that you think would benefit from the information - maybe even send them the links if you'd like. That's tremendously helpful.

Today, as in previous episodes, I've touched on some things as they relate to supplementation. As always, I always cover a lot of tools that are zero cost tools that don't involve ingesting anything at all - behavioral tools. But I mentioned some supplements that I particularly find useful. With supplements, it's a complicated landscape often because many supplement companies don't put in the bottle what they say is in the - the particular product. We've partnered with Thorne - T-H-O-R-N-E - because Thorne is a supplement company that we know to have the highest levels of stringency. It's used by the Mayo Clinic. It's used by all the major sports organizations for that particular reason and because their quality standards are exceptionally high. If you'd like to try any supplements and see the ones that I take, you can go to Thorne - [T-H-O-R-N-E.com/u/huberman](https://thorne.com/u/huberman). And if you do that, you'll get 20% off anything that's listed there on my page as well as any of the supplements that Thorne sells. That's Thorne - [T-H-O-R-N-E.com/u/huberman](https://thorne.com/u/huberman) - to get 20% off anything that Thorne sells. In addition, if you want to follow us on Twitter, we're there [@hubermanlab](https://twitter.com/hubermanlab). Or on Instagram, [@hubermanlab](https://www.instagram.com/hubermanlab). I also do some content on [@hubermanlab](https://www.instagram.com/hubermanlab) - a little neuroscience posts. Some are reposts of clips from the podcast. Others are unique content that you won't find on the - on the podcast, so you can follow us at [@hubermanlab](https://www.instagram.com/hubermanlab). Also, if you like, check out our Patreon - [patreon.com/andrewhuberman](https://patreon.com/andrewhuberman). And most of all - and as always - really appreciate your time and attention today. I hope you practice some of the tools if they're right for

you. I hope you think hard about stress and how you can control your stress. And above all - as always - thank you for your interest in science.