

Huberman Lab #18 - Using Cortisol & Adrenaline to Boost Our Energy & Immune System

Function

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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 is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and reach your health goals. I've long been a fan of doing blood tests. And more recently - as they've been developed - also DNA tests. And the reason for that is that so many of the factors that impact our immediate and long-term health and that inform our health choices can only be analyzed by way of blood or DNA tests. The great thing about InsideTracker is they make getting the blood and DNA tests extremely easy. They'll come to your home if you'd like or you can go to a place where you can get your blood drawn and your DNA swab taken there. As well, once you get the information back from InsideTracker, it's very easy to understand what to do with that information - how to interpret it. And that's really what sets InsideTracker apart, I believe, from other blood and DNA testing tools and companies. Most sources and companies will give you information back about what your levels of hormones are and metabolic factors, etc. - but no clear directives about what to do with that information to get those markers in the ranges that you want in order to optimize your health. InsideTracker makes that all very easy. It gives you directives about exercise, about nutrition, about various supplements you may or may not want to take. And once again, only through blood and DNA tests can you access that information. If you want to try InsideTracker, you can visit insidetracker.com/huberman. And if you do that, you'll get 25% off any of InsideTracker's plans. That's insidetracker.com/huberman to get 25% off and enter "huberman" at checkout.

Today's episode is also brought to us by Athletic Greens. Athletic Greens is an all-in-one vitamin mineral probiotic drink. I've been taking Athletic Greens since 2012. And so, I'm delighted that they're sponsoring the podcast. I started taking Athletic Greens and I still take Athletic Greens once or twice a day because it covers all my nutritional, vitamin, mineral, and probiotic bases. Of course, you can get vitamins, and minerals, and probiotics from food. But many of us, including me, find it hard to do that on a consistent basis - especially when I'm working a lot, when stress and sleep aren't optimized, etc. With Athletic Greens, I make sure to get all the things I need. And then, all the other supplements I take or what I eat, I can consider additional insurance. The great thing about Athletic Greens is it tastes great. I like to mix mine with water and a little bit of lemon juice. I take it once early in the day and then sometimes again in the afternoon. The fact that it includes probiotics is really important to me. There are so many data now pointing to the fact that probiotics, and gut-brain health, and gut health, generally, are very important for metabolism, for hormone output, for neurotransmitter production - so many vital things related to our health. Athletic Greens makes it easy to make sure that I'm getting everything that I need in the vitamin, mineral, and probiotic department. If you'd like to try Athletic Greens, you can go to

athleticgreens.com/huberman and claim a special offer. They'll give you five free travel packs plus a year's supply of vitamin D3K2. There's now a ton of data as well pointing to the fact that vitamin D3 and K2 are important for a huge number of health-related factors - including hormones, metabolic factors, neurotransmitters, etc. So, they have the year's supply of vitamin D3 completely free along with your Athletic Greens offer - and you get the five free travel packs. So, if you'd like to try that, you go to athleticgreens.com/huberman and claim this special offer.

Today's episode is also brought to us by Headspace. Headspace is a meditation app that makes meditation easy. I started meditating many years ago, but I found it was difficult to stay consistent with my meditation practice. In fact, when I would get stressed or really busy - that's when I probably needed the meditation practice the most - and that's when I tended to drop the meditation practice and run around doing other things. So, it was really a - kind of - catch-22. I learned about Headspace a few years ago on JetBlue flights when they had them included as an option of whether or not to watch a movie, or a television show, or do meditation. I tried the meditation and I really liked it. Very easy to follow along with a Headspace meditation. The meditations that they include on the Headspace app or also backed by dozens of peer-reviewed quality independent studies. And of course, there are now thousands of peer-reviewed quality studies pointing to the fact that a meditation practice is beneficial for sake of improved sleep, for reducing stress, and a number of other health metrics - cardiovascular disease risk, etc. The great thing about Headspace is it's allowed me to stay really consistent with my meditation practice. They have meditations of different duration and different type. So, you never get bored. I actually look forward to my meditation practice and it continues to benefit me. In fact, since starting Headspace, I've been consistent with meditation for much longer than I ever had previously. If you want to try Headspace, you can go to headspace.com/specialoffer and you'll get a free one-month trial with Headspace's full library of meditations for every situation. That's headspace.com/specialoffer to get a one-month free trial. That's their best offer out there right now. And then, you can try their full library of meditations for every situation.

Today, we're going to continue our discussion about hormones. And we're going to focus on how particular hormones influence our energy levels and our immune system. Now, last episode I mentioned at the end that we were concluding our month on hormones, but we decide to include this additional episode. So, this would be the fifth episode in the sequence of episodes about hormones because there are two hormones which are vitally important for a huge number of biological functions that we'll talk about today, but that are particularly important for energy levels and your immune system. This is something that I get asked about a lot. So, rather than skip to the next general topic, today we're going to talk about the hormones cortisol and epinephrine - also called adrenaline.

You do not have to have heard the previous episodes on hormones in order to understand and digest the material from today's podcast. If I mention anything related to previous episodes, I promise to give a little bit of quick background to get everyone up to speed. Today, we're going to talk about the biology of cortisol. We're going to talk about the biology of epinephrine. As always,

we'll talk mechanism and there are going to be a lot of tools. If you're somebody who struggles with stress, and energy levels, and balancing stress and energy levels - today's episode is going to be vital for you. If you're somebody who has challenges with sleep or you're somebody who has challenges getting your energy level up throughout the day and getting your energy level down when you want to sleep - today's episode is also for you. And we're going to talk about the immune system and how to enhance the function of your immune system. We're also going to get into some fun topics related to learning, and memory, and how you can leverage cortisol and epinephrine, in particular, in order to learn faster. We're going to talk about so-called nootropics - smart drugs - and how they work because there's several of them that tap into the epinephrine system that aren't often discussed and that you have access to. We're going to talk about how caffeine can actually rewire your brain for better or for worse. And we're going to talk about the biology of comfort foods, and why they work so well, and what they're doing. And in understanding that, you'll be able to better understand your food choices as they relate to short-term and long-term energy.

So, we have a lot to cover. Everything will be timestamped. I want to just remind people that we caption every episode in English and in Spanish. The captions take a day or two to pop up on YouTube. So, if you're not seeing those within the first couple days, please be patient with us in order to get captions that actually read similarly to what I'm saying. We go through a captioning service. And so, we have them done by experts and that takes a little bit of additional time.

Meanwhile, if you have any questions as the episode evolves, please write them down. Please put them in the comments section. Please subscribe to the channel if you haven't already. And let's get started talking about how to increase your energy and improve and increase your immunity by leveraging the biology of cortisol and adrenaline.

Intermittent Fasting

Before we dive into the biology of increasing energy and your immune system, I want to cover three topics that I promised I would mention from previous episodes. The first one relates to intermittent fasting. The second one relates to why your stomach grumbles. I forgot to mention the biology of that last time. And the third is a powerful way to increase growth hormone - which is powerful for increasing metabolism, fat burning, and tissue repair, etc. - that doesn't involve a sauna or wrapping yourself in plastic bags and going for a jog.

So, first: intermittent fasting. Last episode, I talked a lot about growth hormone and thyroid hormone. And I mentioned things - like sauna, and exercise, and sleep - and how they can increase levels of growth hormone - within the healthy ranges - and why increasing growth hormone can be very beneficial because it can burn off body fat, it can improve muscle and general tissue health - cartilage, etc. And we tend to lose - or our levels of growth hormone or reduced as we age. Many people ask me, "Well, what about fasting?" Everyone's been promised on the internet that intermittent fasting leads to these big increases in growth hormone.

The reason I didn't mention it is that I couldn't find a study that actually pointed to the underlying mechanism. I saw lots of claims - lots of podcasts - lots of degrees behind people's names - sometimes biologists - sometimes entirely different fields talking about this - but very few studies. And then, I found what I would consider the study. We will link to this study. Turns out that fasting does increase growth hormone levels and the way that it does it is fascinating. I mentioned in a previous podcast about hunger, and timing of meals, and timing of hunger - that when you're hungry, you release a hormone in your body called ghrelin - sometimes, actually, called ghrelin. Thanks for all of you ghrelinistas - or ghrelinistas - that corrected my pronunciation. It's both - ghrelin or ghrelin. Either one works. Ghrelin makes you hungry. When blood glucose - your blood sugar - is low, ghrelin is secreted and makes you hungry. And it turns out that ghrelin - this hunger hormone - actually binds to the receptor in the brain that normally binds what's called growth-hormone-releasing hormone. So believe it or not, the hunger hormone can act like growth-hormone-releasing hormone and thereby stimulate growth hormone.

Now, the levels of growth hormone that fasting promotes through this ghrelin system are pretty substantial. It's about a doubling of growth hormone levels in the waking state. So, we know that you can release growth hormone in sleep. Intermittent fasting, it turns out, can increase growth hormone by binding ghrelin to the growth-hormone-releasing hormone receptor. And it does it, also, during the daytime. So, yes indeed. Fasting can increase growth hormone. Not to the supra-levels that taking growth hormone would increase it or that a sauna could increase it, but it does seem to increase growth hormone. Later in today's episode, we're going to talk a lot about different patterns of fasting and eating that can control epinephrine. And so, we will return to specifics about how long a fast. Do you need to fast for 2 or 3 days? Or 23 hours? Fortunately, for people like me who love to eat, that's not the case. So, we'll talk specific fasting protocols later in the episode.

Stomach Growls

We also said we were going to talk about tummy grumble. When your stomach growls, it is not because of fluid sifting around in there. A lot of people think, "Oh, you know - it's fluid sifting around." Turns out that your stomach has smooth muscle that lines its sides. And when you eat something - or you don't - every once in a while your stomach cinches off at the two ends like a bag with a hose on either end - because that's essentially what your digestive system is. And if there's nothing in there, what happens is the muscles that line the sides of your stomach - they - kind of - extend around the stomach in these cables. Those are always there. And if you have food in your stomach, what they do is they churn your stomach. They literally turn the muscles of your stomach like a tumbler to help break up the food that, presumably, you didn't chew well enough because you were eating too fast. When you don't have any food in your stomach, that churning continues. And that contraction of the muscle and the turning - literally turning over of your muscles - they don't flip over completely. But the turning over the muscles, that's what causes the stomach growling. If you don't want to be the person in the meeting or sitting there at a - in a quiet theater whose stomach is growling, chew your food better. That's the simple solution.

Hot Baths

And last episode I talked a lot about how sauna - controlled, safe hyperthermia - can cause huge increases in growth hormone release anywhere from 300% to 500% - even 1,600% - increases in growth hormone release - really staggeringly high increases. I pointed out that many people don't have saunas in their yard or in their homes. And they would go through some other measures to increase, safely, their body heat - you know - creating a steam room in their bathroom or jogging with extra sweats on - this kind of thing. Many of you asked about hot baths. Hot baths will increase gross - growth hormone, excuse me. However, the temperatures that you need in order to increase growth hormone are high enough that you run the risk of burn. And so, I really can't make any recommendations about hot baths. But if you can tolerate a nice hot bath, you are going to get some growth hormone release. However, the sauna has this advantage of you being able to enter 175 degree or 200 degree environment - providing you're not pregnant, you're not a young child, etc. - you can do that safely - and getting big increases in growth hormone. The hot bath will lead to lesser increases in growth hormone. We're going to talk a lot about temperature regulation in a future episode. But as always, if you're ever going to start playing with hyperthermia or hypothermia - cold baths, ice baths, hot showers, hot baths - that are beyond the kind of norm of what's comfortable - you have to be extremely careful. And please consult a doctor.

Energy & Adrenaline / Cortisol

I think it's fair to say that most people would like to have a lot of energy during the day, - if you work during the day - and they'd like their energy to taper off at night. And I think it's fair to say that most people don't enjoy being sick. Nobody wants to get sick. In other words, you want to have energy and you want your immune system to function well - to ward off infections of various kinds - bacterial infections, viral infections, etc. And it turns out that the two hormones that dominate those processes of having enough energy and having a healthy immune system are: cortisol and epinephrine. Epinephrine is the same thing as adrenaline. In the body, we tend to call adrenaline - "adrenaline". And in the brain, we tend to call adrenaline - "epinephrine". And I'm sorry for that. I didn't create this naming system. And the story behind it is uninteresting and not worth our time. I will use the words "adrenaline" and "epinephrine" interchangeably today. Cortisol is cortisol.

And I just want to cover a little bit about what cortisol and epinephrine are - where they are released in the body and brain - because if you can understand that, you will understand better how to control them. First of all, cortisol is a steroid hormone - much like estrogen and testosterone in that it is derived from cholesterol. Now, that could be cholesterol that you eat. It could be cholesterol that's produced by the liver. As many of you probably know, the relationship between dietary cholesterol - the fats that you eat - and blood cholesterol and liver cholesterol is a very controversial one. It's a barbed-wire topic. There are people that claim that dietary cholesterol has zero impact on circulating cholesterol coming from the liver. There are people who argue the exact opposite. Both with good data in hand, I would say. There are some problems for the idea that all your cholesterol levels are determined by dietary intake - namely, that anorexics often have very high levels of cholesterol that their liver produces, even though they are eating very little - and sometimes not eating at all.

So, understand that cholesterol is a precursor molecule - meaning it's the substrate from which a lot of things like testosterone and estrogen are made. Please also understand that cholesterol can be made into estrogen, or testosterone, or cortisol. And that cortisol is sort of the competitive partner to estrogen and testosterone. What this means is - no matter how much cholesterol you're eating or you produce - whether or not it's low or it's high - if you are stressed, more of that cholesterol is going to be devoted toward creating cortisol - which is indeed a stress hormone. However, the word "stress" shouldn't stress you out, because you need cortisol. Cortisol is vital. You don't want your cortisol levels to be too low. It's very important for immune system function, for memory, for not getting depressed. You just don't want your cortisol levels to be too high and you don't want them to be elevated even to normal levels at the wrong time of day. So, we're going to talk about how to control the timing and level of your cortisol.

Epinephrine or adrenaline has also been demonized a bit. We think of it as the stress hormone - this thing that makes us anxious - fight or flight. You know, we used to get chased by lions and tigers and bears. And now we don't. And it's this ancient hangover. That's all wrong. The fact of the matter is that epinephrine is your best friend when it comes to your immunity - when it comes to protecting you from infection. And we're going to talk about why. And epinephrine/adrenaline is your best friend when it comes to remembering things, and learning, and activating neuroplasticity. We're going to talk about that as well. Once again, it's a question of how much, and how long, and the specific timing of release of cortisol and epinephrine - as opposed to cortisol and adrenaline being good or bad. They're terrific when they're regulated. They are terrible when they're misregulated. And we will give you lots of tools to regulate them better.

Cortisol Biology 101 in less than two minutes. Your brain makes what we call releasing hormones. And in this case, there's corticotropin-releasing hormones. CRH is made by neurons in your brain. It causes the pituitary - this gland that sits about an inch in front of the roof of your mouth - in the base of your brain - to release ACTH. ACTH then goes and causes your adrenals - which sit above your kidneys in your lower back - to release cortisol. A so-called stress hormone - but I would like you to think about cortisol not as a stress hormone, but as a hormone of energy. It produces a situation in the brain and body whereby you want to move, and whereby you don't want to rest, and whereby you don't want to eat - at least at first.

Epinephrine - or Adrenaline - 101 in less than two minutes. When you sense a stressor with your mind or your body senses a stress - stressor, excuse me - from a wound or something of that sort - a signal is sent to neurons that are in the middle of your body. They are called the sympathetic chain ganglia. The name doesn't necessarily matter. They release norepinephrine very quickly. It's almost like a sprinkler system that just hoses your body with epinephrine. That will increase heart rate - will increase breathing rate. In some cases, it will constrict your blood vessels. It will also increase the size of vessels and arteries that are giving blood flow to your vital organs. This is why your extremities get cold when you're stressed and your heart is beating faster. More of that energy is being devoted toward it - toward your core. You also release adrenaline from your adrenals. In - again, sitting - riding atop your kidneys. Those are a second system whereby your system gets

flooded with adrenaline in pulses. So, you can get one pulse. You can get ten pulses. We'll talk about how to regulate the number of pulses. And you release it from an area of your brain called locus coeruleus. And that creates alertness in your brain.

If you want to learn more about the stress response and all the details of that - including some protocols of how to regulate stress - please see our episode about stress. I go into a lot of detail there. I will touch on some of the same themes today, but I really want to cover energy and the immune system. And if you're very much interested in stress per se and stress regulation, please see the episode on stress. Okay, so we have cortisol and we have epinephrine. And their net effect is to increase energy.

Tool - Viewing Sunlight After Waking

So, first of all, I want to give you a tool that will help you regulate cortisol and can also help stave off certain patterns of mental illness. Now, of course, it's not going to cure mental illness on its own, but it can support healthy state of mind and can help reduce unhealthy states of mind - including depression. So, the first tool is to make sure that your highest levels of cortisol are first thing in the morning when you wake up. One way or another, every 24 hours, you will get an increase in cortisol. That is nonnegotiable. That is written into your genome. That increasing cortisol is there to wake you up and to make you alert. It's to stimulate movement from being asleep - presumably horizontal - to getting up and starting to move about your day. And I've said it before, but I will say it again. The best way to stimulate that increasing cortisol at the appropriate time is that very soon after waking - within 30 minutes or so after waking - get outside. View some sunlight. Even if it's overcast, get outside. View some sunlight - no sunglasses. Never look at any light so bright that it could damage your eyes. But do that for 2 to 10 minutes. If it's very bright, 2 minutes. If it's not so bright, 10 minutes. Do that because in the early part of the day, you have the opportunity to time that cortisol release to the early part of the day - which will improve - this has been backed by peer-reviewed studies - it will improve your focus, it will improve your energy levels, and it will improve your learning throughout the day. It will also prevent a late shift in cortisol increase. And late-shifted cortisol - meaning cortisol that increases around 8 or 9pm - is a signature feature of many depressive disorders - including major depression, anxiety - and that, of course, correlates with things like insomnia, etc. So, that's a key tool. And I don't know how many of you are already doing that, but it is vital to do.

Now, I mentioned sunlight even on cloudy days and there are specific reasons for that. So, I want to just briefly cover the data because in the episodes on sleep, I talked about brightness of light in regulating cortisol and sleep. And I talked about how to measure lux - brightness. But I was not specific enough, I realized, based on the questions that I've received since that episode. So, here's how it works. Going outside and getting some sunlight requires that I also tell you how long and under what conditions. I've said looking through a window is not as good. It takes 50 times longer to get as much light, etc., etc. Many, many questions have told me that I'm not being specific enough. So, I'm going to give you the data. And from the data, you will understand exactly how long you need to do this each day. On a sunny day - so, no cloud cover - provided that the sun is not yet overhead -

it's somewhere low in the sky - could have just crossed the horizon - or if you wake up a little bit later, it could be somewhat low in the sky - basically, the intensity of light - the brightness - is somewhere around 100,000 lux. Lux is just a measurement of brightness. If you want to download the app Light Meter. That is a free app that will allow you to do that. You can hold your finger down on the little button there, and you can move it around, and it will continuously give you a lux readout. It's not perfect. It's not exact. But it's pretty good and it is zero cost. I have no relationship to Light Meter - the company. On a cloudy day, it's about 10,000 lux, okay? So, tenfold reduction. But bright artificial light - very bright artificial light - is somewhere around 1,000 lux. And ordinary room light is somewhere around 100 to 200 lux. And it has to do with how much light scatter there is. So, even if you have a very bright bulb sitting right next to you, that's not going to do the job. Your phone will not do the job - not early in the day. To get the cortisol released at the appropriate time, you need to get outside. So, let's just set a couple general parameters. If it's bright outside and no cloud cover - that light can be indirect, you don't have to be staring into the sun - please don't damage your eyes. We can't regenerate those neurons yet and restore vision that's lost. But if you have to blink, that means it's too bright. It's fine to blink, of course. Please do if you need to. Get outside for 10 minutes - or five minutes should suffice, but 10 minutes is sure to suffice. If it's a cloudy day - dense overcast - you're probably going to need about 30 minutes. If it's light cloud - broken cloud cover - it's probably going to be somewhere between 10 and 20 minutes. And if you can't get outside, or you're on an airplane and it's bright overhead artificial lights, or ordinary room lights - it's going to take you about 6 hours of light.

And by the time you reach the middle of your sort of wakeful period, it's too late. You won't be able to shift your clock and your cortisol will start drifting later and later. This is why it's vital to get this light on a regular basis - to get that cortisol released early in the day. That sets you up for optimal levels of energy. It sets you up for great sleep. But today's not really about sleep. It's more about energy. That cortisol pulse and the stress that you might feel early in the day from having a little bit extra energy, that is the energy that you want in order to move about and learn and do - and do various things. That is a healthy level of energy. So, please try and get that sunlight if it's within your protocols to do that. And try and get sufficient sunlight first thing in the morning - again, within the first hour. That's the best way to make sure that you time your cortisol appropriately.

Cortisol Throughout The Day

Now, throughout the day, you're going to experience different things. Most of you are not spending your entire day trying to optimize your health. Some of you might be. But most of you have jobs, and you have families, and you have commitments. Life enters the picture and provides you stressors. And those stressors, whatever they may happen to be - a difficult coworker, some disappointment about something, you didn't get the raise you expected, or you didn't get the vacation that you expected. Those will cause increases in cortisol and epinephrine. This is important to understand. You don't have the - the luxury of just having this morning cortisol and then having it taper off. You want that major cortisol early in the day, but then you can expect - you should expect - increases in cortisol and adrenaline throughout the day based on events that are unpleasant to you. So for me, the events that are most unpleasant to me are things like traffic, emails that ask me to fill out a

form for which I can't find the link. These kinds of things stress me out. I'm a human being. I don't lose my cool over them, but I can feel my level of alertness and - kind of - frustration increase - the normal - kind of - things that go with stress - tense up a little bit. The key is these blips in cortisol and epinephrine need to be brief. You can't have them so often or lasting so long that you are in a state of chronic cortisol elevation or chronic epinephrine elevation. This system of stress was designed to increase your alertness and mobilize you towards things - get you frustrated and provide the opportunity to change behavior. That's what they were designed to do.

Ways To Increase Adrenaline, Epinephrine & Cortisol

So, if you find yourself getting stressed and staying stressed, there are great tools that we provide in the stress episode that relate to things like the double inhale, exhale - the so-called physiological sigh. You can incorporate an NSDR - a non-sleep, deep rest protocol, etc. But understand that the energy that you experience during stress - that sudden increase in alertness and attention that comes from seeing something difficult - that is a healthy hormonal system and neural system that's working. And the reason it works is that cortisol - when it's released into the bloodstream - it actually can bind to receptors in the brain. It can bind receptors in the amygdala - fear centers and threat detection centers - but also areas of the brain that are involved in learning, and memory, and neuroplasticity. And this is why I say that neuroplasticity - the brain's ability to change itself in response to experience - is first stimulated by attention and focus - and often, a low-level state of agitation. So, understand that and you won't be quite so troubled about the little stress increases that you experienced throughout the day.

Now, there are ways to leverage stress - epinephrine and cortisol - in ways that serve you and to do it in a deliberate way. There are also ways to do that that increase your level of stress threshold - meaning they make it less likely that epinephrine and cortisol will be released. So, I want to talk about the science of those practices, because I get asked about these practices a lot - things like Wim Hof breathing - which is also called Tummo breathing - things like ice baths - things like high-intensity interval training. All of those things have utility. The question is how you use them and how often you use them. Those tools - just like stress from a life event - can either enhance your immunity or deplete it. That's right. Those same practices of ice baths, Tummo breathing, high-intensity interval training, or training of any kind can deplete your immune system or it can improve them - excuse me, they can improve it - meaning they can improve your immune system. The key is how often you use them and when. And so, I want to review that now in light of the scientific literature. Because in doing that, you can build practices into your daily - or maybe every other day routine - that can really help buffer you against unhealthy levels of cortisol and epinephrine - meaning cortisol increases that are much too great or that last much too long - epinephrine increases that are much too great or that last much too long. And of course, we'll talk about all the negatives that go along with having too much cortisol - too much epinephrine - for too long. But you hear about those a lot. You hear about Cushing's syndrome. You hear about abdominal fat accumulation. You hear about sleep disturbances. I want to arm you with the tools first. And then, we can talk about the dark side and all the things that, hopefully, you'll be able to avoid entirely - or that you can get yourself out of once you have the tools in hand.

Let's say somebody tells you something very troubling or you look at your phone and you see a text message that's really upsetting to you. That will cause an immediate increase in epinephrine/adrenaline in your brain and body. And chances are, it's going to increase your levels of cortisol as well. Let's say you get into an ice bath or a cold shower - even if you love the cold or if you hate the cold, that will cause an equivalent increase in epinephrine and cortisol. We don't know the exact levels, but it's probably about the same. Let's say you go out for high-intensity interval training. You decide you're going to run some sprints. You do some repeats. Or you're going to do some weightlifting in the gym and you love lifting weights in the gym. Maybe you like the powerlifting thing. Or you decide that you want to do some hot yoga or something that you really enjoy - or you hate. You're going to increase your epinephrine and cortisol levels. There's simply no way around this. Let's say you decide to sit down and you're going to do some deep breathing. We all hear about the benefits of deep breathing. So, inhale, exhale, inhale, exhale. You're going to get big increases in epinephrine and cortisol. The data from multiple studies support this. All of those are "stressors" in air quotes.

Now, there is a way that you can cognitively reframe what those are. You can tell yourself, "I love high-intensity interval training", or "I love weight training", or - you know - I personally love exercise. I'm not crazy about the cold. I do some cold exposure stuff now and again. And we're going to talk a lot about how to do that in the optimal way in an upcoming episode. But - you know - getting into the cold doesn't feel good to me. I tell myself it's good for me and I enjoy it at some point - usually when I'm getting out. All of those increase epinephrine. And guess what? They increase your levels of energy and alertness. So, if you're somebody who struggles with energy and alertness, it can be beneficial - provided you get clearance from your doctor - to have some sort of protocol built into your day where you deliberately increase your levels of epinephrine and your levels of cortisol. And I want to put the emphasis on "deliberately".

So, how would you do that? Well, it's quite easy to turn the shower cold and get into that. That will wake you up and it literally wakes you up because of increases in epinephrine. You can do deep breathing of the sort where you inhale and exhale repeatedly 25 or 30 times. Maybe hold your breath for a few seconds on an exhale and then repeat - so-called Wim Hof or Tummo-type breathing. Lots of adrenaline is released into your system when you do that. You will have more energy afterwards. So, it's really important to understand that the body doesn't distinguish between a troubling text message, ice, Tummo breathing, or high-intensity interval training, or any other kind of exercise. It's all stress. Cognitively reframing that and telling yourself, "I like this. I enjoy it." is not going to change the way that that molecule impacts your body and brain. I sort of chuckle because people would love to tell you that all you have to do is say, "Oh, this is good for me." No. What it does to tell yourself that it's good for you or that you enjoy it - is it - that it liberates other molecules like dopamine and serotonin that help buffer the epinephrine response. Now, the way that it does that, I've talked about in previous episodes. But I'll just mention - that dopamine is the precursor to epinephrine. Epinephrine/adrenaline is made from dopamine. Cortisol is made from cholesterol. Epinephrine is made from dopamine. And that's why if you tell yourself you're enjoying something - and because dopamine is so subjective - that you can, in some ways - as long as you're not

completely lying to yourself - you can get more epinephrine. You get more mileage or more ability to push through something. And you can sort of reframe it. But it's not really cognitive reframing. The cognitive part is the trigger, but the - it's a chemical substance that's actually occurring there. It's dopamine giving you more epinephrine - a bigger amplitude epinephrine release - and it gives you some sense of control.

So, here's a protocol that anyone can use if you want to increase levels of energy - if you suffer from low energy during the daytime - or whenever it is that you'd like to be alert. Pick a practice that you can do fairly consistently - maybe every day - but maybe every third day or every fourth day. Maybe it's an ice bath or a cold bath. Maybe it's a cold shower. Maybe it's the cyclic - inhale, exhale - breathing protocol I described. If that wasn't clear - and people always ask for a demo - I'm not going to do the whole thing right now, but I'm willing to do a few rounds of this - or a few cycles, I should say. So, it's inhale [breathing]. I would do that more deeply - more like [breathing]. You do that 25-30 times repeatedly. You will start to feel warm. People in the yogic community - they say you're "generating heat". You're not generating heat - you're releasing adrenaline. Inhale, exhale, inhale, exhale - 25 or 30 times - you will feel agitated and stressed. That's because you're releasing adrenaline in your body. And that's because you're releasing norepinephrine in your brain. And you'll be more alert. Then, you can follow that 25 or 30 breath cycles with an exhale hold [breathing]. And hold your breath for 15 to 30 seconds. Always, always, always do this on dry land - never while driving - operating heavy machinery - all the standard safety protocols - never near water, please. People have passed out and died doing this with breath holds in water. There are several deaths associated with it. On land, it's probably safer. Clear it with your doctor. But 25-30 breaths. Exhale, hold. 25-30 breaths again. Exhale, hold, 25-30 breaths again. Exhale, hold. And then if you'd like, you can do an inhale and hold if that's within your margins of safety.

Using Stressors to Enhance Our Immune System

So, if all these protocols - all these activities - are just equivalent. They're just stress. Then, how do we make them good for us? How do we actually benefit from them? Now, of course, the cold itself can have some health-promoting effects. It can increase brown fat thermogenesis and metabolism. High-intensity interval training or other forms of exercise, of course, has cardiovascular effects that can be good for us - as does weight training, etc. But what we're talking about here are ways to increase energy and to teach our brain and body - to teach ourselves - how to regulate the stress response. So, in addition to the benefits of the actual practices, what we're talking about is building a system so that when you experience increases in epinephrine and cortisol from life events, you're able to better buffer those. And we are also talking about ways that you can increase energy overall - because that's what today's episode is all about: energy and the immune system. And indeed, we will talk about how you can actually leverage specific protocols to increase your immune system on demand. There's great scientific data to support that one can do that.

So, there's a biological mechanism that's very important if you want to do those things - increase energy and your immune system on demand - learn to buffer stress on demand - in real time. And it

means taking these protocols - these practices - whether or not it's cold water, or ice bath, or exercise, or any of those - and making one small but very powerful adjustment in how you perform them. But in order to make that adjustment, I can't just tell you the adjustment. I have to tell you the mechanism so that you know if you're doing it correctly or not. This is really a case where if you can understand a little bit of mechanism, you will be far better off than just adopting protocols. So, if you take away nothing else from this episode except what I'm about to tell you, please take away the information I'm about to tell you.

Cortisol, as I mentioned, is released from the adrenals and it can bind to receptors. It can have action both in the body and in the brain. In fact, it can bind the so-called threat detection center in the brain - or one of them - which is the amygdala - also called the fear center. It can do that because cortisol can cross the blood-brain barrier. It can be released in the body and cross this biological barrier. It's like a fence that keeps things out of the brain, but cortisol has passing rights. It can go through. Epinephrine cannot. Epinephrine is polarized. The shape of it is such that it can't make it through the blood-brain barrier. That's one of the reasons why it's released both from the adrenals in your body and released from this brainstem area - the locus coeruleus - in your brain. That's a powerful thing because what it means is that the body can enter states of readiness and alertness while the mind remains calm. That is biologically possible. It's not just a psychological trick. And there are ways that one can do that.

So, I'm presuming at this point that you're getting your morning light to time your cortisol increase. I'm presuming that you want more energy or that you want to increase your immune system's function and its ability to combat infections of various kinds. And what I'm suggesting is that you pick from the palette of exercises that are out there - or tools that are out there - to increase epinephrine. There are a lot of ways to do that. You can do that, as I mentioned, through cold water - through exercise. You can even do that by having confrontations with other people. At a biological level, it is identical. So, if you like to go online and place the kind of comments that - or read the kinds of things or look at the kinds of things that agitate you, you can if you'd like look at that as an opportunity. I'm not suggesting you do that. I'd like to see people taking care of themselves and each other in much less destructive ways, frankly. But the prerequisite here is getting an increase in adrenaline released from the body. Now, the simplest way to describe how to do that would be in the context of cold water or a breathing protocol. Because then, I don't have to deal with the unknown life circumstances that get you triggered - or I could tell you what gets me triggered, but I'm not going to.

So, let's presume cold water. So, let's say you decide you're going to take a cold shower. You get into the cold shower. And if it's cold enough, that will be stressful. You will experience an increase in epinephrine. It will increase your alertness. Now, you're using this as a practice - as a tool - to build - you could call it resilience - but the ability to stay calm in the mind while being stressed in the body. Epinephrine is in the body. And you do that by subjectively trying to calm yourself. Now, you can do that by telling yourself it's good for you, by emphasizing your exhales - anything that you can do to try and stay calm, despite the fact that you are in a heightened state of alertness. You do this with

exercise. You do this with music. Pretty much anything that will give you a really heightened state of alertness offers you the opportunity to try and stay calm in the mind. What you're trying to do at a mechanistic level is to have adrenaline released from the adrenals, but not have adrenaline/epinephrine released from the brainstem to the same degree. So, you're not just trying to buffer this. You're not trying to say, "Oh, this is good for me. This is good for me. I'm going to grind this out." You're not trying to grind it out. You're trying to move through this calmly while maintaining alertness. You're not trying to zone out necessarily - although, maybe that helps. You're not trying to distract yourself. What you're trying to do is shift, cognitively, your relationship to the somatic - to the body stress response.

Now, I'm sure some of you out there are shouting, "Yeah, that's exactly like..." - whatever, whatever, whatever. I agree. This is, in many ways, a self-directed - kind of - stress inoculation. But we're not talking about this as stress inoculation. We're talking about this as a way to increase energy and focus. And the reason is that epinephrine - when released in the body - has a profound effect on the immune system. And when released in the brain, has a profound effect on the ability to learn and remember information - and to be alert. And so, we're talking about splitting the location - separating the location - from which you have epinephrine/adrenaline released, okay? So, let's say you are doing this practice simply to wake up. Okay, cold shower will do that. Exercise will do that. The ability to stay calm in mind while having heightened levels of adrenaline and, presumably, cortisol as well - in the body. But the cortisol is going to circulate everywhere. We'll talk a little bit about cortisol more in a moment. You could do that through some self-soothing, calming way. That's going to be highly individual. You could do it by telling yourself you enjoy it, etc. But what you need to understand is that in the immediate period following that practice, your system - your entire brain and body - are different. Your body is actually primed to resist infection when you have high levels of epinephrine in it for short periods of time.

Research - McEwen

So, the scientific study that explored how increasing adrenaline in the body can improve immune resistance is grounded in a well-known phenomenon that increases in stress actually protect you against infection in the short term. So, I want to look at the classic data first - describe what was done. And then, I want to talk about the more recent study - which is immediately actionable. There are a classic set of studies that are really based mainly on the work of somebody named Bruce McEwen - who is at the Rockefeller University in New York. Bruce passed away a few years ago, but he had many decades of incredibly impactful work under his belt when he did. The work that I'm going to talk about next has been done in humans, and has been done in animals, and has really explored how inducing stress can enhance the function of the immune system in the short term. And when I mean short term, I mean about 1 to 4 days. I'm not going to go through all the details of the study, but essentially what they were doing was exposing subjects to some sort of infection - either bacterial or viral infection - and inducing stress. Sounds like a double whammy, right? You'd think that maybe getting a little electric foot shock, or cold water exposure, or something to increase your levels of stress and adrenaline would just make the effects of the infection worse.

But, no - quite the opposite. Brief bouts of stress - which now you should be thinking about in terms of cortisol and epinephrine release - were actually able to increase immune system function.

Now, that shouldn't surprise you if you understand a little bit about how epinephrine works in the body and in the brain. It essentially is the signal by which the nervous system can inform immune organs - things like the spleen and other organs - that make killer cells of various kinds - B cells and T cells - to go in combat infections - bacteria and viruses. How else would your immune system know that there was an infection? Your immune system can recognize foreign invaders, but the nervous system provides the signal - the sort of alarm signal - that liberates the killer cells - that tells them there's a problem and to go seek out the problem, so to speak. So, the duration here is really important because if stress stayed too high for too long - then yes, indeed, stress can hinder the immune response. But for a period of about 1 to 4 days, it actually can protect you by way of increasing the immune response. Now, I can say with certainty that that effect is governed by epinephrine - adrenaline released from the adrenals and not from the brain - because they actually explored whether or not the effect exists in the presence of what's called an adrenalectomy - or removing the adrenals. So, I should just say: Without the adrenals, you don't get the effect. So, we know that that effect comes from adrenaline in the body.

What does that mean for you? That means if you want to increase your immune system in the short term, you want to increase your epinephrine in the short term. That's why short bouts of very intense exercise - probably no more than an hour per day - provided you're doing everything else right - sleeping and nutrition, etc. - maybe even shorter bouts of intense exercise - or exposure to cold water or the cyclic breathing that I talked about before. Because they increase epinephrine, they will bolster the immune system. And we all hear these reports every once in a while. It seems to be the thing that every once in a while, there'll be an article about how coffee can improve your immune system or something like that. Indeed, caffeine can increase epinephrine and dopamine to some extent. But most people are drinking it chronically. So, its effects are probably due to increases in epinephrine. And, probably, whether or not something like coffee or other forms of caffeine can improve or degrade your immune system will probably depend on whether or not you're using it in a way that it increases your adrenaline as a spike that happens rarely - you know, once every - you know - two or three months. Let's say you have an infection coming on. Yes, indeed. It probably - what these data probably mean is that drinking some hot caffeinated tea or some hot coffee even - provided you don't get dehydrated from it because you're also drinking some water - can probably improve your immune system function by way of increasing adrenaline release. But so can the breathing, so can cold exposure, so can exercise.

The mechanism here is what's key. And I keep saying that because what it means is that you don't actually have to know the specific protocol. I'm not trying to say, "Do this particular protocol." You have to figure out and it should be easy to figure out what short-term adrenaline increasing behavior you're willing to do on a regular basis - every day - or 2 or 3 times a week. Now, you could say, "Well, I'm not sick. Should I be doing these things often?" You know, I would say 2 or 3 times a week at a minimum. If your goal is to keep your immune system tuned up and you are in the

presence of a lot of children, for instance - which carry a lot of - of bugs because their immune system is in developed - or you work in a healthcare setting or you're simply somebody who's prone to get sick. I can just say anecdotally - I guess someone now calls this "anecdotal" - which - I don't like that phrase because it's sort of - I don't want anecdotal data to ever be misunderstood as anything but anecdotal data. Anecdotally, I can say that I've had instances where I've felt a - you know - a throat tickle coming on or some sinus infection. I will do the cyclic breathing that I described before - 25-30 breaths - exhale, hold - 25-30 breaths - exhale, hold - and then, big inhale, hold. And most times I didn't get full-blown sick. But I also take other precautionary measures to get sleep, etc. So, whether or not it was causal or whether or not it's just correlated, I don't know.

Research - Kox

However, there's a human study that I definitely want to point out to you because it - it was published more recently than the McEwen work. It was published in the Proceedings of the National Academy of Sciences for the USA - because there are Proceedings and National Academy of Sciences for many other countries as well. The title of the paper is "Voluntary activation of the sympathetic nervous system..." - that's the system that causes fight or flight and - a.k.a. stress - and causes release of adrenaline - "...and attenuation of the innate immune response in humans". This is Kox - K-O-X et al. - P-N-A-S - Proceedings of the National Academy of Sciences - 2014. And they incorporate the ever-famous Wim Hof breathing. Wim Hof breathing is much like the breathing protocol that I've described several times now in this podcast. It's also called Tummo breathing. Other people from other cultures and communities have called it other things. The naming really isn't important - although, I do think Wim is a pioneer in trying to bring these practices to the general public more broadly and was involved in this study. The study was done in the Netherlands. It was communicated by Dr. Tamas Horvath at Yale. I mention all that - Horvath is a - is a terrific scientist. I'm familiar with his work over many years.

Here's what they did. They injected people with E. coli and they had groups that either did the sorts of breathing I've been describing that increase adrenaline release - although, I should say - I don't think you need to be able to do that. I don't think you need that breathing to get adrenaline release. You could do it with cold exposure. You could do it with other things - high-intensity interval training as well. And what they found was that the response to the E. coli was quite different in the people that had a protocol - in this case, breathing - to increase adrenaline. So, this is a remarkable study because what they found was that the fever, the vomiting - all the negative effects of E. coli - many of them - and in some cases, all of them - were greatly attenuated by way of engaging the adrenaline system - in this case, using breathing. They looked at inflammatory cytokines - things like IL-6 - which I've mentioned many times on this podcast - the sort of classic inflammatory cytokine - were reduced. Things like IL-10 - which are anti-inflammatory - were increased. There were some inflammatory cytokines that were increased.

What's the point here? The point is you can control your immune system by finding a way that you can increase adrenaline. And this runs counter to what we always hear, which is, "Don't get too stressed or you will get sick." Learn to control adrenaline - turn it on and turn it off. Learn to control

cortisol - turn it on with light in the morning. Try and turn it off. Then, when it spikes because of life events, learn to turn it off. Learning to turn on and off adrenaline - a.k.a. epinephrine - and learning to turn on and off cortisol - affords you the ability to turn on energy, and focus, and your immune system. That's the most important point from today's podcast. And understanding that it doesn't matter what protocol you use. Maybe it's a cup of coffee and running up a hill 5 or 6 times. That will improve your immune system function if you get adrenaline in your system. You can use an ice bath. You can use a cold bath. It really doesn't matter. You can get into an argument, but I'm not suggesting you do that. It really doesn't matter. What's important is that you're able to then shut off that response. And there are ways to do that we will talk about. But I want to talk about some of the other benefits of epinephrine and cortisol that occur because of their actions on the brain - because these are many and they are powerful. And they relate to energy, but also the ability to learn.

Research - Kalsbeek

If I haven't already convinced you that seeing light early in the day is good for timing your cortisol, I should also mention that another hormone that I discussed last episode - which is thyroid hormone - and is critical for setting your level of metabolism - is controlled, in part, by these circadian mechanisms and cortisol itself. The short takeaway on this is that if you get your cortisol release early in the day, it will increase your energy throughout the day. It will also time your thyroid release properly. So, there's yet another reason why you would want to get that light exposure early in the day. For me, that's a nonnegotiable practice. If I'm on a plane, I'll try and get it any way I can. I'm - I'm not shining flashlights in my eyes yet, but I really try hard to get that light exposure from sunlight early in the day without fail. And the thyroid increase has to do with the fact that your circadian clock itself is regulated by cortisol. And the circadian clock times the release of thyroid hormone. I don't want to go too far off in that direction, but there are a number of studies - Kalsbeek et al. - K-A-L-S-B-E-E-K et al. - 2012. If you want to look it up on PubMed - is a great one that describes how cortisol secretion begins to rise during sleep and peaks shortly after waking or immediately before. And that times a set of neurons in the circadian clock that then trigger the release of the releasing and stimulating hormones for thyroid. So, a really important mechanism. And thyroid will also tend to correlate with energy, but mostly metabolism. Very important to have thyroid in check.

Increasing Performance & Memory

Now, let's talk about epinephrine, and cortisol, and learning, and memory. Everyone has a story about being so stressed they couldn't remember something - you know - sit down to an exam. I actually had this happen once. Sat down to an exam and just blanked - just blanked. It only happened once. I don't know what happened. I don't think it was sleep deprivation, but I just completely blanked. And it was very hard for me to pull myself out of that ditch. I did manage to do it, but it was a scary experience. So, I think most people think about stress and an inability to perform. However, most of the time increases in epinephrine - provided they are not through the roof - lead to improved performance. Now, this has been shown over and over again on memory tests, on learning new information, on physical performance - that when blood levels of epinephrine are low, you don't perform very well. When blood levels of epinephrine are very high - up to about

1,500 to 1,700 picograms per mille - if you - if anyone's out there who's actually measuring this stuff, but I doubt you are - performance goes way up. Performance gets better when you are alert and when you're a little bit stressed. Absolutely - shown again, and again, and again. If you get too stressed, it's the mental side. - it's the epinephrine in the brain - that causes people to either focus on their somatic response too much - like they feel like they're sweating and they're focused on their bodily response. They're not focused on what it is they're trying to do, or say, or perform, etc. - or learn. But epinephrine is a nootropic - it is a smart drug - that we all make internally. And cortisol is as well.

Now, here's the twist. That does not mean that you want epinephrine high during the exam, necessarily. Memory, and learning, and performance are actually favored - they are enhanced - by epinephrine increases immediately after learning. And that's something that's rarely discussed. The timing is vital. So, if you learn some information, you have a conversation, you're trying to learn a new language, a new motor skill - whatever it is that you're trying to learn - the increase in epinephrine that occurs just afterward is what's going to consolidate the information. It's going to ensure that the proper circuits and mechanisms in the brain for neuroplasticity are engaged during sleep later that night or the next night - which is when the real rewiring occurs. And you might say, "That's crazy. Why would that happen?" Well, we have to remember none of these mechanisms evolved for us to do what we want and learn what we want necessarily - although, they will allow us to do that. We've experienced this before. We might have gotten up, gone outside, get in our car, drive to work or to somebody's house. You're not thinking about much at all. And then, all of a sudden you see an accident on the road. Your alertness is primed if it happens to be a particularly gory accident. There's going to be a lot of sensory information there. All of a sudden, adrenaline/epinephrine is released into your brain and body. Guess what? Not only will you not forget that event, but you will remember everything that led up to that event - which has an adaptive function because your brain and body's primary concern is safety, right? This is the neurobiological explanation for Maslow's hierarchy of needs. It's safety first. And so, you have heightened awareness and alertness for everything that preceded that spike in adrenaline and cortisol. So, the way to think about this is if you need to learn something better - if you're taking Adderall or you're taking a lot of coffee beforehand, you're actually driving the process in the wrong direction. You're increasing epinephrine for learning, sure. But past a certain point, you're actually degrading learning and performance. The time to do that is toward the end or immediately after the learning because this mechanism is not simply devoted to negative events like a car crash or a trauma. It works to make sure that the hippocampus that encodes memories as part of the memory-encoding mechanisms is primed - that it's told, "What you just experienced is important. You're going to need that information later."

And so, I've talked many times before about using non-sleep, deep rest (NSDR) or ensuring good night's sleep after learning. But what we're also talking about is as the learning event tapers off - as you're exiting that - to make sure that your epinephrine levels are not tapering off as well. And this may be one of the reasons why the 90-minute cycle - the so-called ultradian cycle for learning - works. Because it takes a few minutes to get into rhythm of learning. You can maintain that

alertness for about 90 minutes. It's no coincidence that these podcasts are typically about 90 minutes long. And as you exit that 90 minutes, you're still going to start to feel fatigued. You're not going to be able to continue to secrete epinephrine at the same level. So, I'm not telling you that at the end of this podcast, you should give yourself a foot shock or that you should jump into an ice bath - although, I will say if you were to increase your epinephrine at the end of this episode by breathing or by way of cold shower, I'm willing to bet based on numerous published studies that the memory for the information would be enhanced because of this retroactive effect of epinephrine and cortisol. Put simply, you can remember things better if you increase your alertness - a.k.a. your level of epinephrine and cortisol - after - immediately after something that you want to learn. So, I'm reminded by people here at the Huberman Lab podcast that the optimal strategy, therefore, would be a 90-minute session of focus or learning. Then, immediately after, cold shower, or Tummo-type breathing, or ice bath, or something of that sort - maybe a hard run or HIIT training if you can't get access to the other things. And then, shower up and do a non-sleep deep rest. And then, get a good night's sleep. Those would be the optimal tools and the organization of tools for enhanced learning.

Research - Magalhães

And of course, you could use caffeine to prime the whole process by drinking the caffeine towards the tail of the learning episode - which is counterintuitive, at least to me. I should mention, since many of you use caffeine and I use caffeine - I do drink coffee, I love mushroom coffee, I love maté, I drink caffeine in various forms - that there was a study that came out recently that is relevant to our discussion about energy, and alertness, and learning. And the study came out just recently - March 2021. It's Magalhães et al. - so, M-A-G-A-L-H-A-E-S. And it was published in Molecular Psychiatry - which is a fine journal - a peer-reviewed journal. And the title pretty much gives it away: "Habitual coffee drinkers display a distinct pattern of brain functional connectivity". Chronically drinking coffee changes brain connectivity. And it does it in a number of ways, but the key takeaways from this study as it relates to sort of what the circuits do - as opposed to me just listening off a bunch of brain circuits, which is kind of meaningless in this conversation - is that people who drank coffee habitually every day had changes in their brain circuitry such that there was a shift or a bias toward anxiety, even when they don't ingest caffeine.

So, a lot of times we think, "Oh, caffeine increases your levels of anxiety." And indeed, it appears it does - if you use it chronically. But not just to caffeine. It doesn't just raise your baseline of anxiety because of what's circulating in your bloodstream. It actually increases connectivity between the brain areas that relate to anxiety. Now, that could be a good thing or a bad thing depending on how you look at it. For people that have - are prone to - you know - chronic panic attacks or anxiety attacks - that's not going to be good. Some people might use caffeine in healthy ways - I believe I do - in order to just increase overall levels of alertness. Although now, not only am I going to start delaying my caffeine intake until 2 hours after I wake up - for reasons I've talked about in previous episodes - but I'm also going to start drinking it later in learning and focus sessions as a way to enhance plasticity around those learning and focus sessions - not before. So, interesting study. Feel free to - it's free online. You can access the full paper online. We will put a link as well.

Nootropics

I want to mention this - this issue of nootropics - so-called smart drugs - which is not a topic that I particularly enjoy because I don't like the name. I don't like the idea of a nootropic because: What is a smart drug? Well, there's different kinds of "smart". There's creativity. There's task switching. There's strategy building. There's strategy implementation. And most of the nootropics that are out there are just cocktails of a bunch of different things that aren't tailored to the individual at all. They all seem to have some caffeine, or some cholinergic stimulation, etc. But there's an important way to frame this in light of today's conversation. Nootropics generally fall into two categories. One category are nootropics that increase blood glucose. So, these are compounds that people take that increase blood glucose. And increasing blood glucose will improve performance and can enhance learning in some situations. I'm not suggesting people take these things, but here's just a list of a few of those. Some of them are legal. Some of them are gray market. Some of them are illegal. Piracetams, oxiracetams, the aniracetams - all the tams, okay - elevate blood glucose. That's how they work. The neural effects that you hear are secondary or tertiary to the fact that they just increase blood glucose. And we know that because if you block the blood glucose effect, you block the nootropic effect, okay? Others include - and definitely don't take these, please - amphetamine - cocaine. Those will increase learning in the short-term in particular dosages, but because they increase blood glucose. And then, of course, things like painful stimuli or stress will improve learning by way of increasing blood glucose. Now, stress and epinephrine that's associated with it not only improve performance during the learning bout - but as I mentioned before, having epinephrine come up afterward will increase the retention of that information in the long term.

And then, of course, there's a whole category of nootropics that don't impact blood glucose - that work by increasing the cholinergic's system activity. And these are things like choline, lecithin, physostigmine - that's a prescription drug, phosphodiesterase. So, there are ways to increase energy that don't require increasing blood glucose. And this is vitally important. The reason we're talking about epinephrine and cortisol for increasing energy and immune system function is because they are largely independent of blood glucose. Of course, they interact with that system. But we heard so much growing up, "You need to eat for energy." But the energy that we're talking about today is actually a much more powerful one than the one that you derive from food. It's - we could call it neural energy. It's neurotransmitters that create alertness, and focus, and the willingness and the ability to move, and the willingness and ability for your immune system to move in response to intruders. So, I think we all too often think about food as energy - which is great because it is. But there are other sources of energy that are neural and they relate to these hormone systems - cortisol and epinephrine. And that's what we're focused on today.

Negatives Effects of Chronically Elevated Cortisol & Epinephrine

So, up until now, we've been talking about increasing energy and increasing the immune system by way of cortisol and epinephrine. But I'd be totally remiss if I didn't cover how cortisol and epinephrine - if chronically elevated or if elevated too high - can have a lot of detrimental effects. These are the things we normally hear about. I'm going to describe some of those things, but I'm also going to talk about ways to ameliorate them - ways that you can adjust the cortisol levels even

if you're stressed - ways that you can adjust epinephrine levels even if you're stressed - so that they have less of a negative impact. I don't have to list off all the ways that stress is terrible and chronic stress is terrible. I think you know. Insomnia - your immune system over time will get battered and you won't be able to fight infection off as well, right? You don't want to be stressed for too long. You can start laying down the sort of classic pattern of cortisol-induced body fat.

Comfort Foods

In fact, there's a whole literature related to comfort foods and why we want to consume comfort foods under conditions of chronic stress. And it's quite interesting actually because it reveals something about the biology of chronic stress that's informative for how to prevent it or to downregulate chronic stress once it's occurred. So, let's talk for a second about comfort foods. And the work that I'm going to refer to is work that was done by a very impressive scientist by the name of Mary Dallman. Her work goes back decades. She was at University of California San Francisco. She asked this question - that on the face of it seems kind of obvious - but for which there was no mechanism known until Mary and her lab personnel came along. And the question was: Why do we seek high fat and/or high sugar foods when we are stressed for a while? Why would that be? And the reason is that the so-called glucocorticoids - of which - cortisol is a glucocorticoid - it's causes we've mentioned before - by releasing hormones from the brain, and ACTH from the pituitary, etc. - but normally, high levels of glucocorticoid shut off the releasing hormones in the brain and in the pituitary. They shut down in a so-called negative feedback loop. So, just like if testosterone or estrogen get too high - that's read out - or that is seen, so to speak - by neurons in the pituitary and brain. And then, we shut down our production of estrogen and testosterone. If cortisol levels get too high - if there's too much cortisol floating around our bloodstream, there's a negative feedback loop and the brain and pituitary shut down CRH and ACTH - which would otherwise stimulate more cortisol. So, cortisol levels go down. So, it's a beautiful negative feedback loop. Chronic stress, however - stress that lasts more than 4 to 6 days - and there's a way to think about what chronic stress really is in an actionable way - causes changes in the feedback loop between the adrenals, and the brain, and the pituitary - such that now the brain and the pituitary respond to high levels of glucocorticoids - cortisol - by releasing more of them. It becomes a positive feedback loop. And that's bad. It actually gets right down to levels of gene regulation, and transcription, and translation. And so, you really don't want chronic stress because it's a cascade of stress equals more stress equals more stress. So, this is why it's very important to learn to turn off the stress response. You don't want it elevated for too long.

So, there's one study that Dallman and her colleagues did where they stimulate chronic stress by increasing corticosteroids - cortisol. And they found that subjects would increase their consumption of sugar and fat. In fact, they would even eat lard. They would just - it sounds disgusting, but they were willing to just eat more fat and more sugar. And that led to all sorts of things like type 2 diabetes. That led to dysfunction in the adrenal output, etc. And so, the real key is to learn to shut off the stress response. Because the interesting thing is - is that Dallman and colleagues - and some studies that followed up on their work - found that if the system was kicked into motion for too long, then there was a tremendous shift overall towards anxiety because it turns

out that body fat itself receives neural innervation. It received - neurons actually talked to body fat. So now, you have body fat releasing certain hormones. You've got the adrenals releasing cortisol. And all of that is feeding back to the brain to make you want more sugar and fatty foods. So, that's how the so-called comfort foods work. And you should watch yourself next time you experience stress. If it's a short-term bout of stress, typically it blocks hunger. If it's a longer bout of stress, typically it triggers hunger - in particular, for these so-called comfort foods - sugary and fatty foods.

Bombesin

And it's kind of interesting how short-term stress can actually block hunger. It does that by activating or interacting with a system called the bombesin system. Bombesin is a peptide hormone. It was actually - I think it was named after some sort of reptile - some sort of - or amphibian, excuse me - some sort of toad. I think it was initially sequenced from the toad before it was later discovered in humans. And I think the toad's latin name is "bombina bombina" - or something of that sort. And so, they decided to call this thing "bombesin". But it reduces eating. And stress liberates bombesin and makes you want to eat less. But chronic stress causes all these positive feedback changes - which are not positive - they're positive - I'm calling them "positive" because they amplify the stress response over and over, not because they are good for you. So, short-term stress - great. Long-term stress - really, really bad.

Gray Hair

Other bad effects of stress that we can talk about - and I won't list off too many more of these because you know so many of them - you hear about them - you really want to know how to control them, I'm guessing - is that - yes indeed, stress can make you go gray. The rates at which people go gray - meaning gray hair - in some cases, gray body hair as well - depend on some genetic factors. There's actually - there are a couple ways that we can go gray. There - there's actually a stem cell - what they call niche - in every follicle. So, you have stem cells in the follicle that can produce more and more of the given hair cell. And there are actually peroxide groups. You know, we hear about bleaching hair with peroxide - at least in the '80s, that was a thing - but you can use hydrogen peroxide to bleach things. And you can produce your own peroxide in the hair follicle that will cause the hairs to go gray. In addition, pigmentation of hair - just like pigmentation of skin - is controlled by melanocytes - our old friends, the melanocytes. And I say "old friends" because on previous episodes, I talked about why sunlight and getting ample sunlight can increase levels of certain things like melanocyte-stimulating hormone - which reduce hunger. It can improve testosterone and estrogen levels - and all the reasons for that. Well, it turns out that activation of the so-called sympathetic nervous system - which is really just another name for the system that liberates adrenaline from the adrenals and epinephrine in the brain - drives depletion of melanocytes in hair stem cells. So indeed, there's a rate of aging that we will undergo based on our genetics, but stress will make us go gray.

Research - Zhang

And the paper that you should look to if you want to read more about this came out very recently. This is Zhang et al. - Z-H-A-N-G et al. - Nature - fabulous journal - definitely one of the apex journals - 2020. So, this paper showed that the activation of stress in various forms will deplete these melanocyte stem cells. You do not have to worry about an ice bath, or hard exercise, or breathing increasing your levels of stress to the point where it's going to make you go gray. We're talking, again, about chronic stress. And if you want to offset the stress effects on graying of hair, you can do that by either having a practice that helps you regulate stress on a consistent basis. So, something like non-sleep, deep rest or meditation. If you can get access to massages or vacations, those are great. But having a practice to keep stress clamped so that it's not chronically elevated. That will be great. As well, this is another case where sunlight, we know, stimulates melanocytes - not just in skin, but in hair. And so, getting ample sunlight - having a practice to regulate stress - will offset the stressed-induced graying of hairs by way of stress-induced depletion of melanocytes. And if "melanocyte" sounds a lot like "melanin", you're right. That's because anything involved with pigmentation in the brain and body generally has "melano" up in the front of the word in some way or another.

Recap

So, if chronic stress is so bad because of its effects on epinephrine and cortisol being elevated for too long - then the question becomes, of course: Well, what's chronic stress? How do I know the difference between chronic and acute stress? And how do I keep chronic stress at bay? Because of all these negative effects. And I didn't even list out the number of other ones - the effects on depression, which certainly has a correlate with elevated cortisol. Thyroid hormone is associated with - low thyroid hormone is associated with depression - mistimed thyroid. Once again, getting your light, and your, feeding, and your exercise, and your sleep on a consistent schedule - or consistent-ish - is going to be the most powerful thing you can do in order to buffer yourself against negative effects on mental health - and physical health, for that matter. There are things that one can take, supplements, prescription drugs, etc. Some of you out there may have or may know people to have Cushing's - which is chronically elevated cortisol. There are prescription drugs that we will talk about that can be used. But most people are dealing with a situation where life gets stressful, then less stressful. Stressful, then less stressful. I would say based on the data from McEwen and others - Bob Sapolsky's lab over many years - I would say any stress that lasts more than a day, or two days, or three days is starting to become chronic stress. There's really no strict cutoff because we're not measuring everybody's cortisol from moment to moment. My lab has done experiments where we measure stress in people over time. People vary tremendously in their ability to have a really hard day and then fall deeply asleep. That's going to be the ultimate reset - is the ability to sleep well more or less undisturbed each night - although, one or two wakeups during the night - probably not going to be too detrimental - provided they're not too long and you're not viewing light during those wakeups or your phone.

Tool - Ashwagandha

But the things that you can take if you feel like you're chronically stressed and you're veering toward some of the negative effects of stress are many. There are some simple things that people can do in terms of supplementation. All supplements, of course, have to be checked out for their safety margins for you because it's going to differ from person to person. You're responsible for making sure they're safe for you if you decide to use them. One of the most common ones is ashwagandha. And it has a powerful anxiolytic - anti-anxiety - effect. You're welcome to go to examine.com, and for zero cost, you can see their so-called human effect matrix. Ashwagandha has many uses. It's been used to enhance power output in athletes. It has been shown to modestly increase testosterone. It has been shown to modestly adjust things like low-density lipoprotein cholesterol - the so-called "bad cholesterol" - in quotes. It has a profound effect on anxiety. That's been shown in nine studies - nine peer reviewed independent studies being funded by organizations that have no vested interest in the answer. It has a very strong effect on cortisol itself. How strong? The decrease in cortisol noted in humans is 14.5 to 27.9% reduction in otherwise healthy but stressed humans. That's great - so, six studies. So, that's - and it mentions this is significantly larger than many other supplements. Now, some people will say that taking ashwagandha chronically may not be good. If you've heard about that or you can point to specific studies that indicate exactly why it's not good, please put it in the comment section or let me know - in the comment section on YouTube would be best.

The studies that I'm referring to did explore both genders. The number of subjects was reasonably high - 64 or more. One to six months studies - so, these were long-term studies. That's great. You like to see that - not just an - an acute study. So, males and females - lots of different ages - a weight - excuse me, overweight - and non-overweight. They did blood draws of cortisol, which is going to - as well as saliva tests. Saliva is actually the best way to measure free cortisol. You can also measure it from earwax, which sounds pretty gross - and kind of is. But nonetheless, that's where cortisol will accumulate - in earwax and in saliva - the free cortisol. But that's six very quality studies - independently supported - that all point to these very significant - you know - 14.5 to 27.9% reductions in otherwise healthy adults. So, if you're somebody who is dealing with chronic stress - it's a stressful period in your life and you want to stave off the negative effects of stress - well then, ashwagandha may - I want to highlight "may" - be right for you. It also does tend to lower total cortisol - which is interesting. It can lower depression to a somewhat minimal degree. And can lower, as I mentioned before, things like low-density lipoprotein. So that - I think ashwagandha comes through as - kind of - the - the heavy hitter in this department.

Now, what's interesting also is the other effects of ashwagandha that are downstream of reducing chronic stress and cortisol - because cortisol has so many effects. There are receptors for cortisol all over the body and brain. And so, I'll just list these off quickly. I'm not going to list off each study or talk about how many subjects in detail. Again, you can go to examine.com if you want and just put in "ashwagandha". C-reactive protein - which is a marker of all sorts of negative health effects - cardiovascular health - even macular degeneration - is notably reduced. Heart palpitations - notably reduced. Serum T3 and T4 - our old friends - thyroid hormones = from a previous episode -

are increased. Symptoms of OCD - decreased - both the obsessions and the compulsions, right? Obsessions are of the mind. Compulsions are of behavior. So, there are a lot of things that are downstream of reducing cortisol - lowered heart rate, lowered rates of insomnia, slightly improved memory. Why that would be, I don't know - because cortisol in the short term can increase memory. I'm guessing it's from increased sleep. Decreased pain, decreased quality - decreased reaction times - things of that sort. So, the list goes on and on. But all of those things stem downstream of decreased cortisol.

So, if one were to decide to take ashwagandha in order to reduce cortisol - given that you want cortisol early in the day to have energy throughout the day, the time to take it is probably later in the day or in the evening. I've never heard of it preventing sleep or causing insomnia of any kind. That certainly wasn't listed as one of the major effects on [examine.com](#). I will take ashwagandha from time to time if I'm chronically stressed or if I'm not sleeping as well as I ought to. You might think that with all my knowledge about sleep and sleep protocols that I would sleep perfectly every night. But unfortunately, I have a dog that has a - a canine form of sundowners - of dementia. So, he's up much of the night these days. And so, there's no way I'm getting a solid night of sleep lately. And so, I will supplement with ashwagandha. And typically, I'll take it before sleep and maybe also with my last meal of the day - which is at least 2 hours before I go to sleep. Again, you have to decide if it's right for you. The dosages can vary tremendously. I would just go buy what's off - what's on the bottle from a reputable brand. I would also check out [examine.com](#) because it mentions a range of dosages that people have used and in various studies to different effects.

Tool - Black Licorice / Glycyrrhizin

Now, there is something out there that some of you may actually be taking or ingesting that can increase cortisol - and not so incidentally, can decrease estrogen and testosterone - because remember cortisol is made from the cholesterol molecule - so is estrogen and testosterone - so are estrogen and testosterone, excuse me. And it's competitive. So, you're either making more cortisol or you're making more of the sex steroid hormones - estrogen and testosterone. Believe it or not, licorice - which I always thought of as a candy - but licorice contains a substance that I can't pronounce. G-L-Y-C-Y-R-R-H-I-Z-I-N - glycyrrhizin - which is of the *glabra* species of plant. Actually, because of its chemistry - this 18-beta glycyrrhetic acid - you don't need to know all that - licorice, black licorice, contains a substance that increases cortisol. And its increase is not huge, but is - is significant. This has been looked at in females age 18 to 29 - males and females age, 18 to 29 - people age 30 - these are separate studies where I'm listing off the different ages - ages 30 to 64. Turns out that you can see pretty substantial increases in serum cortisol and decreases in testosterone and estrogen. So, that was complete news to me. Also, increases in blood pressure that are pretty substantial. That's going to be downstream of cortisol. Increasing cortisol is increased blood pressure - in order to engage the stress response. It's part of this stress response. Increased hormones of other kinds that are associated with stress. So, who knew? I didn't know. Maybe you knew previously. If you did, forgive me. But licorice and some of the compounds in black licorice can actually increase stress. Probably not the thing to be ingesting during periods of chronic stress. Whether or not anyone has had positive effects of using it to increase cortisol in

other contexts - let me know. But very interesting that the chemistry of licorice increases stress hormones. And therefore, you would probably want to - almost certainly we want to avoid it - in conditions of chronic stress. Also, if you're trying to optimize testosterone and estrogen, licorice seems like a bad idea.

I suppose one instance where you might want to use licorice would be if you're traveling and you're trying to wake up at a particular location. Because licorice has these effects on cortisol and cortisol is associated with the waking phenomenon, and alertness, and energy - you could use it in that regard. However, I would be careful to time it so that you're not getting two cortisol increases throughout the day - two peaks. So, you're going to want to make sure that you're doing all the other things correct for jet lag and adjusting to jet lag. And if you want to know what those things are - including timing your feeding, using temperature, using exercise, using light to adjust a jet lag more quickly - please see the episode that we did on jet lag and shift work where I cover all those protocols in detail.

Tool - Chamomile / Apigenin

The other compound that I think deserves attention is apigenin - A-P-I-G-E-N-I-N - apigenin - which is what's found in chamomile. Apigenin - I've talked about previously. It has various effects. One is it is a mild anti-estrogen. That's been shown in various studies. And it does have a bit of an anxiolytic effect - of reducing anxiety. I take it before bedtime - 50 milligrams. Again, you have to decide or figure out if that's safe for you or not. I'm not suggesting you take it. The major source of action is to calm the nervous system. And it does that, primarily, by adjusting things like GABA and chloride channels - but also has a mild effect in reducing cortisol. So, ashwagandha and apigenin together, I would consider the most potent commercial compounds that are in supplement - nonprescription - form that one could use if they were interested in reducing chronic stress - especially late in the day by way of reducing cortisol late in the day.

Protocols For Optimizing Energy / Immune System Function / Learning

So, you're probably getting the impression that cortisol and epinephrine are a bit of a double-edged sword. You want them elevated but not for too long or too much. You don't want them for days, and days, and days - but you do want to have a practice in order to increase them in the short term. So, we should talk about protocols that can set a foundation of cortisol and epinephrine that is headed towards optimal. Optimization is always going to be a series of regular practices that you do every day. So, sleeping at certain times, light at specific times, food at specific times, certain foods, etc. And that's highly individual, but there are some universals and we've covered a number of those in the discussion today. Meal timing - meal schedules has a profound effect on energy levels. And as I mentioned before, the energy I'm referring to is not glucose energy. It's not burning carbs while running or ketones. What I'm talking about is neural energy - epinephrine and cortisol. Fasting and timing one's eating are two sides of the same coin. So, even if you're on a - kind of - standard three meals a day with a couple snacks in between diet or nutrition regimen, you are fasting whenever you're asleep - or you're not ingesting any calories. So, unless you're hooked up to an IV of glucose, you are fasting while you're sleeping. There are several different kinds of fasting that can relate to

epinephrine and cortisol. I will do an entire episode on optimizing food intake for performance in the sports context. That's coming up. But in the meantime, I'd like to just talk about fasting as a source of epinephrine. Anytime when our blood glucose is low, cortisol and epinephrine are going to go up. If we fast for too long, that is stress. There's no way around that. Now, that doesn't mean it doesn't have other beneficial effects. Running a marathon is stress, but it can also have positive effects - if that's your thing. So, stress has been demonized as a term, but we want to think about stress mechanistically - as epinephrine and cortisol. And then if we do that, we can think about how to regulate its timing. So, anytime we have an eaten for 4 to 6 hours, levels of epinephrine and cortisol are going to go up pretty substantially. There's an exception to that - which is if you are used to eating on the clock - every 2 hours or every hour - being half hour late or being even 10 minutes late on that schedule will induce stress. Most of that psychological stress, but also the release of things like ghrelin that are going to make you hungry because they're on that eating clock.

So, one thing that many people do to great benefit is they follow a so-called circadian eating schedule. They eat only when the sun is up. They stop when the sun is down - more or less. The other way to think about this is they stop eating a couple hours before sleep and they eat more or less upon waking - assuming that they're waking up more or less around the time the sun rises - maybe plus or minus 2 hours, okay? So, it's sort of typical schedule. Now, let's say you decide to do what I do - which is I skip breakfast. I drink water. I delay my caffeine for 90 minutes to 2 hours. And then, I drink my caffeine. And then, my first meal is typically around lunchtime - 11:30 or 12. And yes, occasionally, I throw back some almonds, or walnuts, or something earlier in the day. I - I do do that from time to time if I get hungry enough or if I just happen to see them. I'm kind of a drive-by eater. If I see blueberries, or nuts, or something - I just - kind of - pick them up and put them in my mouth. I try not to do that off other people's plates, but I just have that habit of doing that from time to time. But typically, I don't eat until about noon.

So, I've got a cortisol increase. I've got my sunlight in the morning. So, I'm getting a big pulse in energy early in the day. And yes, there's a little bit of agitation. I am hungry sometimes early in the day - sometimes no. But my ghrelin system is used to kicking in right around noon. At the point where I eat - as long as I don't eat carbohydrate - in my case, I know that my epinephrine levels are going to stay pretty high. So for me, it's usually meat and salad - or something of that sort - or fish and salad - although, I don't particularly like eating fish because of the taste. But I'm essentially low-carb or keto-ish throughout the day. So, I'm probably in a slightly elevated state of epinephrine and cortisol throughout the day. Some of you are fasting even longer. You're pushing out till 4pm or 8pm - or maybe you're even fasting around the clock. Anytime you're fasting, you're increasing epinephrine and cortisol release. You can do all the meditation in the world to keep your mind calm, but you are closer to that edge of stress. And you're closer to that edge of peak stress. So, that's something that's just important to understand. The description about comfort foods and cortisol was one of - kind of - an extreme case where cortisol systems kick over to a positive feedback loop. But we all eat to suppress cortisol and epinephrine. When we're hungry, cortisol and epinephrine create an agitation. So, we go seek food. When we ingest food - that typically if it includes

carbohydrate, there's a blunting of cortisol. There's a blunting of epinephrine in the bloodstream. If you've ever had too much coffee to drink - and you go and have a couple pieces of bread - you will feel the - the - you'll - you might describe it as "the caffeine getting soaked up out of your system", but what you're doing is you're elevating blood glucose - which is more or less saturating the effect of caffeine in your system. Not completely, but it's going to have that effect. If you're very stressed and you sit down to eat something, it will calm you down. Yes, because some of the blood that goes to your stomach, but more so because these effects in blunting cortisol and epinephrine.

Water Fasting Myth

So, the important point here is that if you want to be alert, you can do that by way of not eating. Of course, please ingest fluids. I know some people water fast out there. I am yet to see good science on water fasting and why that can stimulate stem cells or - people love the idea of - after the Nobel Prize was given for autophagy - and this idea that our cells clean up debris and senescent cells. Yes, that's true. But the idea that water fasting is going to promote that, I find rather amusing. Please send me the data if you know some great study in a decent journal. But pretty much this is something I hear about. I don't think water fasting is a good idea. Nor should you be drinking so much water that you kill yourself. You can actually drink enough water that you - that you die. So, I think ingesting water in healthy amounts is a good thing. Stay hydrated. But if you want to be alert, stay hydrated. Caffeine may or may not be in your regimen.

Recap

But fasting will make sure that your levels of energy are up and you will be primed very well for doing a protocol of the sort that we talked about earlier in this episode of breathing, or cold exposure, or exercise to get that increase in the immune system function. And if you do that after learning - after trying to learn something - it will increase learning for that particular set of information - whether or not it's motor, or language, or whatever it happens to be - mathematic, programming. So, fasting is a tool for many reasons. It can increase growth hormone, etc. But today, I'm talking about fasting as a tool to bias your system toward more epinephrine/adrenaline release and toward more cortisol release, but still low enough that it's not chronic stress - that it's not causing negative health effects.

Tool - Prescription Drugs

But please know that if life is very, very stressful - if you're experiencing lots of stressors and you're chronically fasting, you are positioning yourself toward a greater likelihood of being chronically stressed in the ways that are negative - negative effects on the reproductive axis, lowered testosterone and estrogen, negative effects on - you're gonna - your hair will turn gray. There's reasons for that. Your sleep will suffer. Your immune system will suffer. So, I think - while it's nuanced, our discussion today about epinephrine and cortisol increasing energy and immunity are designed to help you understand when you should be doing certain things - when you should throttle back - when you might want to kick up your adrenaline a bit. If you're suffering from low energy because you're just kind of feeling down and a little bit underactivated, well then the practices of ice baths, and intense breathing, etc. could be very beneficial - so might fasting. But if

you're feeling exhausted and burnt out - so drained and stressed - well then, fasting, or doing a lot of cold exposure, or doing a lot of intense exercise is driving you further and further into chronic stress. So, because I don't have a saliva test or a blood test - or God forbid, an earwax test - to measure your cortisol as we're engaging in this discussion together, you have to gauge for yourself whether or not you are in a state of underactivated and need more epinephrine and cortisol - or whether or not you are over activated in terms of cortisol and epinephrine and you need ways to buffer those - ashwagandha. Maybe it should be a warm mellow bath, not a nice bath. So, one has to learn how to regulate these hormones with behavior, with nutrition, perhaps with supplementation. And then of course, there are prescription drugs. And I - I always leave these to the end because (a) I'm not a medical doctor. I'm not prescribing anything. I'm a professor. I'm professing a number of things that you can decide for yourselves what to do with or not. But of course, there are prescription drugs that can increase cortisol or decrease cortisol in cases like Cushing's syndrome - which if you have that diagnosed, you should talk to a physician. You should talk - ideally, to an endocrinologist - but to a physician of some sort - board-certified physician. There are drugs that can be used to treat injury like corticosteroids that you can inject to reduce inflammation in injury but they are cortisol. So, they're going to bias you towards more stress in other domains. Remember, cortisol can cross the - cross the blood-brain barrier so you're going to be more prone to psychological stress.

Tool - Separating The Brain-Body Experience

I also want to mention again that I think there's great benefit to having a practice that, perhaps, you do every other day. But if you can't, maybe every third day or every other day - of deliberately increasing your adrenaline in your body while learning to stay calm in the mind so that you learn to separate the brain-body experience. You know, we hear so much about how beneficial it is to unify the brain and body - that we're all out of touch with our brain and bodies. I - I - I particularly dislike claims like that or statements like that because there's great power, as we learned today, in having your body activated by some sort of stimulus - cold water or even psychological stress - but learning to stay calm in your mind. I should just remind you that most of the negative effects on your life and on the lives of others are due to people - perhaps you - but I hope not - being unable to regulate their mind when they have high levels of adrenaline in their body - either because they read something in a text or a comment section. Of course, that never happens to me. But it may happen to you. Of course, it happens to me. But the idea is to stay calm in your mind so that then you can regulate your action, alright? And so, I think that there are these practices that one can develop over time that are really straightforward and zero cost, right? You could find any number of ways to increase your adrenaline and stay calm. And we tend to focus on things like exercise as the way that we get our energy up. But today, again, I'm talking about deliberately increasing adrenaline while staying calm mentally because that has great utility when the adrenaline hits through unwanted events - through things that we didn't seek out.

So, the ability to regulate adrenaline and cortisol is about inducing them deliberately when you want to push back on infection - potential infection - from bacteria or viruses. It's about pulling back on adrenaline and cortisol - maybe through the use of supplementation but certainly through

proper use of light, and sleep, and mental tools that we talked about as well - when they are chronically elevated. It's about training your system not just to be unified at brain and body which sounds great until you're stressed - and then, that's terrible. It's really about having a deliberate dissociation between the adrenaline response from the adrenals and the adrenaline response from the brainstem.

Conclusion

So, once again we've covered a ton of material. I hope right now you're thinking, "Okay, am I in a state of chronic stress? Am I underactivated? Or could I afford to increase my levels of adrenaline cortisol to improve my relationship to my immune system and to energy - neural energy? If you liked the information and - that you heard today - and you want to remember it - well then, at the end of this episode perhaps you go do something to increase your level of adrenaline - and now, you know what some of those things are - because it will help you retain the information. Or you could apply that to anything else that you learn or experience, of course. And I hope that you'll think about some of the ways in which cortisol and adrenaline are not good or bad - that stress isn't good or bad - but short-term stress is healthy. Alertness and energy is healthy - even if it puts you at the edge of agitation. That's an opportunity to learn how to control these hormones better. And I hope that if you're in a state of chronic stress, that you'll do things to start tamping down some of that stress and that you realize that your nervous system and your hormone system are linked but they're linked in ways that you can control - that we don't have to be slaves to our hormones - and certainly not the hormones that cause us stress. We can learn to control those both to the benefit of our body and benefit of mind.

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Today, we rounded out the discussion about hormones. We aren't going to continue with that topic any longer. We are moving to a new topic segment for an entire month or so. If you know of other people that you think could benefit from the information on this podcast or that you think would enjoy listening to it, please forward it along to them. We'd really appreciate that. Another great way to support us is to check out our sponsors that we mentioned at the beginning of the podcast. We also have a Patreon. It's patreon.com/andrewhuberman. There, you can support the podcast at any level that you'd like. I should mention that I will be answering some questions that come up

frequently in the comment section on YouTube in Instagram Lives every once in a while. I am on Twitter @HubermanLab. I'm on Instagram - also @HubermanLab. And on Instagram from time to time coming up, I'm going to be discussing answers to your common questions in these Instagram Lives. And I will make sure that they're recorded. So, you can check those out. Please follow our Instagram if you are not already doing that. And check out our Twitter if you're on Twitter.

I covered a lot of different types of tools today - behavioral tools, etc. - but I did mention supplements. For those of you that are interested in supplements, we've partnered with Thorne - T-H-O-R-N-E - because we believe them to have the highest levels of stringency and quality in terms of supplement production, in terms of amounts of supplements in their different formulations, etc. If you want to check out the supplements that I take and you want to get a discount on Thorne supplements, you can go to Thorne - T-H-O-R-N-E.com/u/huberman - and you can get 20% off any of the supplements that I take or any of the supplements that Thorne - that Thorne sells for that matter. That's thorne.com/u/huberman to get 20% off anything that Thorne makes. Thank you for joining me for what I hope was an informative discussion and an actionable discussion about how to increase energy and the immune system by way of cortisol and adrenaline/epinephrine. I really appreciate your willingness to learn new topics - as well as to embrace and think about new tools and whether or not they're right for you. And as always, thank you for your interest in science.