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[00:00:00] **Dave:** You're listening to The Human Upgrade with Dave Asprey.

Today's cool fact of the day is that anxiety may be inherited from your parents brain activity patterns and researchers found a pattern of this brain activity that's tied to anxiety and traced it through generations of monkeys. The results of this large study of about 400 monkeys bring us a little closer to understanding severe anxiety and how it's inheritable.

This came from the University of Wisconsin School of Medicine, and they say this new activity pattern Really acts almost like genes going through your family tree. They measured anxious temperament by subjecting young monkeys to a stressful situation and they measured how they responded to that to that situation.

In other words, how strong of a response they had and they measured their levels of cortisol and they figured out which monkeys stress harder than other monkeys. And then they scanned the monkeys brains under anesthesia. And the monkeys that had the bigger stress response showed a crucial difference in the extended amygdala, which is a brain structure in its surrounding that's known to be involved in fear and threat detection.

Oh, and if you meditate, it's probably involved in some of the more esoteric spiritual states you can achieve when you train it the other way, but no one ever talks about that. That wasn't in the study either. But two parts in particular of the amygdala, the central nucleus and the bed nucleus, of the stria terminalis behaved in lockstep in the high stress monkeys.

And this is through functional MRI scans. And they found if your parents had it, the kids had it along with that anxious temperament. What this means is that you can blame your mom for your mitochondria, but you can blame both of your parents for your anxiety. Either that or maybe you should just do some basic forgiveness and all that stuff and be done with that crap because you can retrain your amygdala.

They didn't put that in the study either, but that's been a big part of my path to being not an anxious jerk. Now, I typically like to foreshadow and you can wonder, am I going to be talking about monkeys, fMRIs, or anxiety? In this case, well, none of the above and maybe a little bit of the above because we are talking about Neuroscience and we're talking with a leading Bay Area based PhD who studies comparative neurology to understand our brains and brain evolution and he's doing this at Stanford School of Medicine where he's a professor of neurobiology.

And he's made a bunch of important contributions to the field of brain development, brain plasticity, neural regeneration, and repair, so of course that's why I want to talk to him. We're talking about none other than Dr. Andrew Huberman. Andrew, welcome to the show. Thanks so much for having me. I'm thrilled to be here.

If you are a fan of neuroscience, which is pretty likely if you've been listening to the show for a while, we're going to define all of our terms as we go through the interview. If you didn't know what the amygdala was, that's okay. Now, Andrew, you know, like so much cool stuff. I almost didn't know where to start when I'm thinking what I ask you because you talk about increasing cognitive capacity.

Which is, which is really cool. And you've done some really crazy martial arts and scuba diving. Like you're, you're a very fit neuroscientist as opposed to, you know, the thick glasses, white lab coat and a overhanging belly. That's probably the stereotypical neuroscience guy. So let's start there.

What's up with increasing cognitive capacity arousal system? Like, what does that even mean?

[00:03:32] **Huberman:** Yeah. So, I've long been interested in perception, cognition, all of neuroscience, and the short history of this is the following. So really there are five components to how you go through life, and only five. And they are the things you sense, Right?

The things you perceive, so which, which of those sensations you're focused on.

[00:03:59] **Dave Asprey:** So you could sense something, but you wouldn't consciously know you sensed it, you're saying.

[00:04:02] **Huberman:** That's right, so I could say, you know, right now you're sensing the bottoms of your feet in contact with the floor, but until you think about it, you weren't paying attention to it, you weren't perceiving it.

Correct. But you're sensing things all the time. You can't turn off the sensory epithelium, as we call it, the sensory sheet of your eyes, and your ears, and your nose, and your mouth, and your, and the rest. You, you basically, you're sensing things

[00:04:23] **Dave Asprey:** all the time, but. You, you can turn those off with either lidocaine or LSD, right?

[00:04:28] **Huberman:** Yeah, those are pretty extreme. Okay.

[00:04:29] **Dave Asprey:** But I'm saying, but when you do those weird stuff happens, like anytime you walked around going, I can't feel my hands or I can't feel my face after like, those are extreme states that everyone remembers because they're so bizarre. Yeah.

[00:04:40] **Huberman:** I mean, you could amputate a limb too, but it's a good point.

So that, so I guess I'm, I'm referring to like sort of like a basal state. Okay.

[00:04:48] **Dave Asprey:** The normal states. Okay.

[00:04:49] **Huberman:** I don't mean to be nitpicky, but that's, yeah. So, so, you know, you're sensing things all the time and then there's what you perceive, which is what you're focused on. And then you're, there are your emotions slash feelings.

And I'd like to call them emotions, not feelings. Because when you call them feelings, they're sometimes confused with sensations because the feel the feel part, that's just a semantic thing. And then there are your thoughts, which are interesting. We can talk about a little bit more. And then there are your actions.

So that's it. You've got sensations, Emotions thoughts and actions and that's essentially all your experience. And of course you're you're Engaged in those simultaneously to varying degrees at any time. And then there's this thing that they all ride on, which is your level of alertness, or let's call it autonomic arousal.

Some people like to call it stress, but that gets a little tricky. Let's just call it autonomic arousal. Here's what I mean by that. When you're dead, you're not going to experience any of those things. As far as I know. Never been dead, so I don't know. Now, as your alertness, let's say you're fast asleep, you're sensing things, you're having thoughts.

They're not very organized. Most of the time. You can even have feelings, you can have emotions within sleep. We know that. And you have very limited behaviors unless you're a sleepwalker or something like that. But as you become alert and calm, more of those things become available to you like deliberate conscious thought.

And as you, or feelings about. Your morning, you're the people in your life, your life plans, your past, et cetera, as you become more and more, some people like to call it stress, but as autonomic arousal goes up, the weights of those things and what's available to you shifts dramatically. So your ability to engage in conscious, deliberate thought goes down as autonomic arousal reaches peak levels.

So if you're in a panic, it's very hard to think about. Things in a organized way.

[00:06:43] **Dave Asprey:** This is like the stuff Lieutenant Colonel Grossman who wrote On Combat was just on the show. And he talks about the very extreme states, how even soldiers, like, they just go to training because they can't think, they can't do any of that stuff.

And, and you're saying even as you approach that, your cognitive abilities goes down as your stress levels go up.

[00:06:59] **Huberman:** That's right. And there are, and if I look at the whole of wellness or biohacking and I, there are tools that are designed to control autonomic arousal that fall into different categories, like the ones that are designed to raise your ceiling on what you perceive as stress, you know, ice baths, hard runs, these kinds of things.

There's a whole galaxy of those as you know, and then there are the ones that are designed to bring your stress level down once you enter the stress response to kind of tamp it down consciously. And then there are the ones that That are sort of designed to bring your state up, you know Wim Hof breathing comes to mind Oxygen dominated breathing we can get into this in more detail if you like But in any case that the in thinking about brain activity and life experience in this way I became interested in the following question.

So I'm classically a visual neuroscientist, meaning that my lab studies visual perception and the nerve cells and connections in the brain that mediate visual perception. Cause we're just such visually driven animals. About 40 percent of the human brain is devoted to visual processing in some way. As well as merged with other sensory modalities like hearing, but I was interested in why some visual stimuli create anxiety or increased autonomic arousal.

And some perhaps, and we can get into this, actually decrease autonomic arousal and potentially could be used as stress management tools that are very fast in a real time.

[00:08:20] **Dave Asprey:** Do you mean we say visual stimuli, do you mean like flashing lights or pictures of zombies or something like what, what are we talking about?

[00:08:26] **Huberman:** Yeah, great. So if you see a picture of something that frightens you Even if you don't have a phobia, your autonomic arousal immediately spikes. We're all familiar with that. There are things like light exposure, overall light exposure with no form whatsoever, what's called just ambient light, like the overall level of ambient light delivered early in the day will increase your autonomic arousal.

It'll actually increase alertness. There's a very powerful circuit for this, you know, well about this and that you, that's the circuit that you want to avoid triggering. late in the evening, which is why you might wear blue blockers or something to, or not avoid looking at your phone and the wee hours.

Right. So, so light and visual stimuli have a powerful control over autonomic arousal. And the nice thing is in a scientific sense about vision is you can completely control what are called the statistics of a visual scene. So whereas like showing somebody as zombie is kind of a complicated visual stimulus, in some ways it's actually very simple.

I know exactly where the lines are in that image. Yeah. I can make them different contrasts. I can make them different speeds. I can give them more more or less reality. Depending on how I contour them, all of this is to say that a few years ago I decided to start addressing stress. The question of what is stress in the brain?

What are the circuits? What are the, what is the potential for the visual system to be used as an intervention for stress management, both preventing going into the stress response as well as managing the stress response once you're in it. And that brought us to an interesting question, which is the one that you asked, which is how is it that autonomic arousal, which I can modulate using the visual system and I can get into that in more detail if you like.

How is it that autonomic arousal. allows someone to process more information or less information? Is there a sweet spot in which being alert and maybe even slightly more in the stressed regime actually allows me to process information better and faster? And here's the, here's the experiment that we did that led to that hypothesis essentially.

A student in the lab, PhD student, was looking at the fear response in mice, just letting mice run around in this little empty aquarium, no water, and then showing a, an expanding black disc above them. And that essentially mimics their, their experience of an incoming predator. And so, mice will do one of two things.

And they'll do it the first time and they'll do it every time and they don't need to learn it. They'll freeze or they'll run for shelter. Okay, so mice are innately, just naturally afraid. They'll freeze or run for shelter. Now, she mapped the circuits in the brain that mediate that response, and then she started increasing or decreasing the activity of these brain areas.

She found an area of the, of the thalamus, which is just kind of this egg shaped thing in the middle of the brain, called the nucleus reunions. This is a very poorly understood area of the brain, but it connects to the frontal cortex. And here's what was interesting. If she's increased the activity of this brain area that connects the thalamus to the frontal cortex and she showed the animal a fear inducing stimulus.

The animal would confront the stimulus. It would no longer freeze or hide. It would literally walk out to the stimulus and rattle its tail, which is the mouse equivalent of beating its chest and saying, okay, let's go, let's fight. And if she took off that structure, the animals became more fearful. And how was she turning that on?

She was using a two tip, one of two techniques. One is called chemical genetic, where she actually puts a A virus that on its own doesn't really do anything bad, but with the, with, that carries a receptor, it's a muscarinic receptor, that she can inject a drug to either silence or increase the activity of the structure.

This is going to be the future of gene therapy in humans. Things like this, not that exactly. But right now you only do that in mice. But I'll talk about the work we're now doing in humans.

[00:12:07] **Dave Asprey:** That's so, that's so incredible. So just tuning that part of the brain. And I recently did transcranial magnetic stimulation of individual brain structures.

You could probably hit the thalamus with that. In fact, I even have some gear here that does it with magnets. At a lower amplitude than the quarter million dollar gear that they're using at the psychiatrist's office. But

[00:12:27] **Huberman:** yeah, it's coming You know manipulations of brain circuitry are coming and so yeah So this is a circuit that literally changed fear into courage.

And so we asked what what's going on here? And so it turns out that this circuit is allows the animal to bypass the amygdala activation. I know you mentioned amygdala in your intro to bypass amygdala activation and instead to engage the frontal cortex. Now, that was all fine and good and we were excited that we discovered that circuit, but the really interesting part was when she explored the level of stress in the animal when it was engaging in So called courageous or confrontational responses the autonomic arousal measured at the level of heart rate and breathing was actually increased So we think of courage as this kind of calm state that allows you to you know, engage in challenge without experiencing fear or negative emotion But it's quite the contrary and we know this because if someone were attacking you your level of autonomic arousal or stress would go through The roof, but if I just got a snapshot of your response to that you're gonna fight back As if they're just following you, you might hide or get into your car and leave.

So the fear response is actually the lower arousal response. And that was all fine and good and interesting. But then the third thing that she discovered was really what blew our minds, which was that when we did an experiment to ask the animals, and of course mice can't answer, you can ask them all you want, but they won't answer a, we did an experiment where she stimulated this brain area.

When the animals were on one side of this little chamber or the other, this container, we found that they preferred the stimulation side. They love stimulation as pathway. So this confrontational or courage pathway is actually directly linked, we discovered, to the dopamine reward pathway. And it means that successful confrontation of fear.

Meaning not dying, not getting eaten, not doing something stupid, but successful confrontation of fear involves increases in your stress and is heavily rewarded in the brain. So much so, the circuitry is forever changed after that. So this is a paper that we published in Nature in 2018, and it immediately prompted us to say, okay, we have to do this in humans.

[00:14:41] **Dave Asprey:** We do do it in humans maybe not that exact, that exact study, but one of the things, Tony Robbins walking on coals, right, like you feel like you're gonna die, and then you, you stop and you're like, oh, I, I did it, and, and it changes, it rains, or you look at, like, the flow genome stuff, where one of the ways to go into a flow state is, well, just almost die on a mountain bike doing 50 miles an hour, or skis or something, And you get that dopamine hit and you go into this altered state.

It seems like we know that, that there's a reward system because we can see it in the, in certain behavior patterns like that. And, but are you actually able to measure that in humans now?

[00:15:17] **Huberman:** Yeah, so we immediately built up a virtual reality laboratory that looked exactly like the mouse laboratory except bigger, of course, and this prompted us to go collect the most realistic fear inducing or arousal producing stimuli that we could for VR.

So that, so that was what led to my collaboration with shark diver photographer Michael Muller and doing, you know, cage exit shark diving and recording great whites to bring back that footage to the lab and build VR experiences that are very realistic compared to most studies of fear. You know, the history of the neuros of studying neuroscience fear in humans is, in my opinion, has been a little Deprived, let's say, you know, but VR changes that because you can control everything within the VR.

You can look at where people are looking, can measure where their eyes are. You can get subjective reports. You can measure their breathing, their heart rate. But the real twist in all this that made it exciting was we teamed up with a neurosurgeon at UCSF guy named Eddie Chang, a spectacular neurosurgeon to actually record.

Neurons from the human brain, both the amygdala, the visual cortex structures like the insula to actually get measurements of what the brain is doing in humans while people are going through these. Fear, confrontation, courage versus freezing versus types of scenarios and what it's taught us, and it's still early days for the human work I should mention, that work isn't published yet, but what it's teaching us is that the capacity to maintain cognitive load, to perform a cognitive task.

under conditions of high stress and arousal are it actually you can train this up you can get you can essentially access and Produce more cognitive information. You can basically think better. Let's just you know, put it in plain language You can think better and do better in a complex game or in a simple game when your autonomic arousal is higher And so I'm very interested in this because you know I know there are a lot of people walking around that are really stressed and And people who are traumatized and that's terrible.

And certainly everyone should deal with that with the, through the appropriate channels. But there's this real question, like what was autonomic arousal designed to do? Well, autonomic arousal is designed to leverage your behavior. You know, it's designed, once you got hungry enough, you were supposed to get agitated enough that you went and sought food.

[00:17:31] **Dave Asprey:** When you say Autonomic arousal, you're talking about sympathetic, like the fight or flight response being turned on enough, not the, not the sympathetic branch or sorry, not the parasympathetic branch, the rest and reset branch of the autonomic system, right? You're talking about being a little stressed enough to do good work.

[00:17:46] **Huberman:** That's right. I'm talking about why. Here's my theory. I'll try and weave this with some of the more common daily practices with people who don't have electrodes in their heads. You know, I've always found that a little bit of for me, just myself, a little bit of mild hunger or like the intermittent fasting thing or the kind of ketogenic Oriented nutrition always sharpened my focus.

You know, back in 2000 when I was, or 2005 when I was a postdoc at Stanford, my, I got teased a lot 'cause I would drink the oil off the almond butter and everyone was like, oh, gross. I could work very long hours that way. I always liked when I was working long hours to maintain a little bit of sympathetic tone as they say.

You know, be a little bit more on the stress regime when it's time to relax, you know, you can. Eat some starches and crash out. And you could, so the nervous system is highly susceptible to these kinds of manipulations because you have to remember that of course, and you know this, the autonomic arousal, like even the, the stress that people feel around loneliness that was installed in you to get you to go find a mate.

Right. And if you are not lonely, like you have a mate and you've made it recently, then there's a period of time. It varies between individuals where you're content to be relaxed. It's parasympathetic dominance because nature. So you're being the leavers. You're being manipulated from the inside based on what nature wanted you to do, but you can leverage that.

That's the power of that, of that fourth element, which is conscious thought. And so, It occurs to me that there are two states that most people want to be in. Not 50. There are psychedelic states and there are other kinds of states, flow states, but the two states I think most people seek. are alert and calm or asleep.

And I feel like one of the beautiful and exciting things that's happening with this biohacking movement and with the wellness movement and is to find healthy, sustainable ways to be alert and calm when you want and asleep when you want. And if you're not good at it to get better at it. And so while lab doesn't work on those things directly, I'm just fascinated by the extent to which autonomic arousal can be used to As a tool to get you where you want to go.

[00:19:51] **Dave Asprey:** It makes so much sense. It's funny because one of the things that I was kind of embarrassed to put in, in game changers. There are four laws for, for high performance around sex and relationships because it, it's one of those big three things that every cell in your body is wired to do, right?

Like even single celled organisms, if they don't have sex or they don't reproduce in some way, the species will end, right? So we're kind of wired, but I found there, there really is an orgasm hangover, at least for men. And it has to do exactly with that arousal system, like there's a couple of days where you're just relaxed.

But if you wanted to get stuff done. You know, you actually don't get stuff done the next day. You're, you're a little bit more chill and maybe a little bit less satisfied with life because, you know, you're like, yeah, I got, I got nothing to do today sort of thing. So. I published a year's worth of data just on that, which that was the embarrassing part.

But what you're talking about, there's the neuroscience behind that. So you're saying if you don't eat for a little while, not for a long period of time, you might perform better. Intermittent fasting, boom, there you go. I would say if you don't eat and you have some extra ketones from, say, bulletproof coffee in the morning floating around, you're probably going to get even more of that, right?

But. If you go on the number one thing, though, that, that we're all wired to do is run away from kill or hide from scary things. And you're saying having enough of that, even, is cognitive enhancing. But, alright, I'm sitting here, I'm completely vibing with everything you're saying. How exactly am I going to get more of that first, the first F word, the fear F word, as opposed to the food F word?

How am I going to get more of that without, you know, being at risk of breaking limbs and getting TBIs and things like that?

[00:21:29] **Huberman:** Yeah, I mean, I think one of the things that the Flow Genome guys have really spelled out well, I, I went and saw one of their things recently is, you know, this idea that, you know, you want to, you don't, they have this list of kind of suggestions.

They don't call them commandments, but when they're suggestions and I don't work for them, they just, I'm, but I'm friendly with those guys.

[00:21:44] **Dave Asprey:** Yeah, I was the first investor in the Flow Genome Project, so I've been there for a

[00:21:47] **Huberman:** while. Yeah. Okay. Yeah, I'm excited about what they're doing because they're putting things into a really nice framework, which is, you know, you definitely don't want to end up like in a body bag or in jail or do something.

It's

[00:21:56] **Dave Asprey:** always my concern about like, just do high speed skiing and, you know, Not

[00:21:59] **Huberman:** for most people. Yeah. And you can die and people do die. And, and I worry that, you know, the, the threshold for that, especially with YouTube videos and all that, and you know, that I, I watched and enjoyed free solo, but that that's not something that most people, you know, do.

should do. Right. So you have to, you know, you have to be make a very thorough assessment. So it, you know, the threshold is different for everybody, but what I'm, what I would like people to appreciate, and I think certainly you do is that some level of An understanding about what the stress response is really for reframes it from a pathology that we're supposed to run from and control at all costs to something that, you know, you can think about developing tools for.

So I think of tools in terms of off like real time tools and offline tools. So if the work that we're doing now, we look at both. normal subjects and subjects who have generalized anxiety. And again, it's early days, but what we're finding is that one way to measure or evaluate as well as potentially control the stress response in real time is by your, by altering the way in which literally you look at the world.

Now, here's why. So, the visual system has a powerful control over your level of autonomic arousal. So you have to think about which direction you want to go. So let's say I'm alert and kind of sleepy and I don't, I'm not motivated or engaged. There are times when I'm not stressed, I'm kind of under stressed and I need to lean into work or do something.

Yeah, there are a number of ways to do that. Of course, many, you know, your listeners know them and you have many of them. They're powerful. But the, we have two kinds of vision. One is panoramic vision, so called magnocellular vision, because it's carried by big neurons that transmit information very fast, and it's designed to view the world in kind of panorama.

So if you dial out your gaze as you're listening to this, or and just kind of see yourself, but see yourself in the entire room, or even better, if you're outdoors, and you just see everything, the world kind of takes on a spherical shape. That's associated with a, branch of the visual system. You're engaging a branch of the visual system that is more sort of parasympathetic dominant.

It actually is. Animals layer grazing animals only have that system. They don't have what's called foveal vision. They don't have high acuity vision. They're grazing and their only concern is to get their food while detecting if anything comes into their environment. It's actually a system that allows you to process information much faster cause the neurons are big.

for potential threat detection, but it's a low anxiety state. Now there are many yoga practices that are kind of associated with soft gaze and things, but this is the neuroscience of that. And you can do it by dialing out your gaze. By contrast, when you focus your eyes on a, on a single, what's called virgins point, and you enter foveal vision, you're now switching to high acuity, Vision and your perception of time switches.

This is what's key. You're altering the, you start micro slicing time. So big picture time bins are bigger, small picture time bins are smaller. Just simply by virtue of the two parallel circuits that we have in our brains. Primates have in their brains. Lions have in their brains, but animals like sheep and cows don't.

They only have that panoramic vision. So we've been exploring in the lab the extent to which you can use the the, your states of viewing the world as rapid ways to enter and adjust your level of autonomic arousal. So when I'm kind of sleepy and I need to focus and do work, I actually focus on a cross hatch about a, about a meter away in for about a minute.

And it actually acts to lock your, my attentional system. You can actually, there's a blip, a kind of increase in autonomic arousal that goes up with that. And then I personally find it easier than to. Focus on a, on a work task. Conversely, if I'm sort of in a stress state, you know, people always say, okay, control your breathing.

I'm a big fan of breath work as a way to control your breathing. Oh yeah. But the problem is it's closed loop. So if I'm really stressed and I can't control my breathing, then controlling my breathing is an option. But dialing out, it's also not covert all the time. You can't do it in every circumstance.

Can't do it if you're scuba diving. You can't do it under a number, under, you, sometimes you should, but adjusting breathing when in real time is a complicated thing because you don't want to compromise your activity. But you can dial out your gaze and very rapidly adjust down your level of autonomic arousal.

In fact, the visual system is the fastest way, maybe the auditory system as well, to down regulate your arousal. And the answer, the reason for that, comes from neuroanatomy. So here I teach neuroanatomy to the medical students and There are two cranial, there are multiple cranial nerves that feed the so called reticular activating system, this wake up system for the brain.

But the two that people often overlook are cranial nerves two and eight, which are the optic nerve and the vestibular auditory nerve. Wow. So if you, if you recall, the optic nerve was the primary evolutionary, anciently installed mechanism to control arousal. And now you consider that the human brain is 40 percent for vision, and now it makes sense why, okay, Of course you want to block blue light in the evening because that optic nerve, that second cranial nerve is carrying arousal information to the brain.

And if you stimulate it with blue light, which is susceptible to in the evenings, of course, in too strongly, you're going to shift your clock. So our ancient brain used vision. As the, as one of the primary drivers for controlling autonomic

[00:27:25] **Dave Asprey:** arousal. It's interesting. When I, I went through this period, Jesus, this was supposed to be about 10 years ago where I was working with a developmental ophthalmologist, and he had me do all sorts of crazy exercises that over the course of three months I went from 2060 in both eyes back to 2015, and I got rid of stigmatism, and to this day, I'm still 2015.

And I had, I had drifted, so I was like 2060, 2080, something like that. So it, it was kind of magic, but it was an hour of weird vestibular activation exercises. I was exhausted for the whole day after I did these. Like, it was really terrible brain stress, to be honest. I But one of the exercises that made the biggest difference and something that I'll still do today if I need to, is like you rub your hands together like the way you would Like in qigong and then you cup them over your eyes and just open your eyes But all you can see is darkness and if you talk to, you know, Dr Barry Morguland, the Chinese energy master UCLA surgeon who's been on the show a couple times He's like, well, there's special chi that comes out of rubbing your hands, but you talk to A neuroscientist like you, you're saying, well, covering the vestibular system allows the brain to relax and allows the eyes to relax and maybe is triggering that relaxation system.

So I, I mean, I've, I've taught people to do that for anxiety, but I think you've got the mechanism for what's happening there. Is that?

[00:28:44] **Huberman:** No, that's perfect sense. I mean, I think that, you know, I'm, I, as you know, I, you know, I don't shy away from the notions of. Yoga or meditation or, you know, this area, right? So, hold on a

[00:28:54] **Dave Asprey:** second.

Can you be a modern neuroscientist and just completely dismiss all that stuff? Like, has it shifted that far?

[00:28:59] **Huberman:** Well, you know, it's interesting because I mean, people very, my colleagues here are very open mind. I mean, people vary in the extent to which they do these things. I think there's a new generation of people coming up who were exposed to ideas who care about who realized that their nutrition impacts their health.

I mean, I've been, I've been very sad to see colleagues who didn't manage their health well. Here at Stanford, people tend to be pretty health minded, but who didn't manage their health well, you know, who are understood, some of them were, were studying cancer of all things, right? You know, and so you see this where people who study psychiatric illness and then commit suicide.

I mean, it happens. And the reason is that we're all myopic, we're all nearsighted in some way, you know, we all have our blind spots. I think that What's so exciting nowadays is, and this is something I care very much about is that the field of neuroscience is in a position to bridge in a logical, rigorous, and yet open minded way to the fields of wellness and these more kind of what used to be niche fields like Yoga practices and things of that sort.

I mean you it can't be overlooked and you know one reason why I love running my lab so much and one reason why I also am so interested in these fields of wellness and biohacking is because I think Growing up in this area. I really got to see how computer science and engineering that and physics that was once the domain of academics eventually made it into companies like Apple and Google and all these incredible companies.

And I think the same thing is going to happen in neuroscience. I think it's happening now. It's starting where the career options and the paths that these really smart, hardworking scientists and really smart, hardworking people in the wellness communities are going to start to merge through. And I'd like to Serve as a bridge as much as I can for information and other other ways to keep the the flow of information bi directional

[00:30:43] **Dave Asprey:** Andrew you you said something really important that you said a lot of researchers or Physicians or academics that they're they're blind To their myopic or they're blind to certain new ideas you've actually spent probably more of your career than anything else actually studying real blindness and You actually said You I plan to give my entire life to the study of the visual system in one of your interviews with the Glaucoma Research Foundation.

So you're, like, one of the top eye brain interface guys out there, and you're actually working on on curing blindness. Why do you care so much about blindness?

[00:31:21] **Huberman:** I think it's because we're just such visually driven animals, you know, I mean, I love music, but if you took away my hearing, I'd be all right.

Smell I could do without, you know, we have all these wonderful senses, you know, touch is obviously key, but we're just so visually driven. And I think It was early on you know, I was raised in visual system neuroscience, meaning my graduate advisor was in the lineage of these two guys, David Wiesel, who won the Nobel for discovering critical periods.

This idea that you could, your experience during particular phases of life dramatically shaped the brain. It's like, duh, now, but you know, in the early 80s, that, that wasn't necessarily, It was certainly wasn't known. It wasn't data supported. They did that. So they're my scientific grandparents or great grandparents, but I've always been fascinated by vision.

I grew up with a, with a kid. He went to our school this kid Tony, and he walked with a cane. And I remember having a very, very strong emotional response to that. It was just so clear that he wasn't going to be able to do most of the things that any, anyone else was going to do. And and I think it hit me at a kind of a gut level.

I never knew that I'd get. At that point, I'd get into visual neuroscience, but I also, but I know how important I felt, how important the problem was. And then later, my lab was working on development of the visual system. And I thought, well, this is great, but we got to apply some of this to regenerating the visual system.

So we, you know, there was a wealth of knowledge from our lab and other labs on how the eye connects to the brain and vision takes place. And I felt like, look, the time is now. So we did, we published a paper back in 2016 showing that specific patterns of electrical stimulation using screens, not wires, but having mice view particular patterns of visual stimulation could actually enhance regeneration after a blinding injury.

And you know that I got contacted by hundreds, now thousands of patients around the world. Like, can you help me? Can you help my kid? Can you help my wife? This is so debilitating. I'm losing my vision. And so what I decided at that point was this. Kind of the typical line of, Oh, it's going to be five or 10 years before we do this in humans, more studies in mice, more studies in mice.

I thought, you know, enough of that.

[00:33:29] **Dave Asprey:** If you're blind, more studies are not needed.

[00:33:31] **Huberman:** Right. Exactly. Exactly. So I thought, what is a safe and non invasive way that we can bring this to humans now? So one of the things I'm most proud of is, and this was a team effort, of course, and I rely on, on excellent people here at Stanford and elsewhere, but Was to take the timeline of running, taking a result like that to a clinical trial in humans.

Typically it's five to 10 years and we made it 10 months. So right now we're running a clinical trial with the ophthalmology department here at Stanford where there are patients. It's a small number of them still, but we're growing that number who are have VR headsets that they wear put on five times a week for a 30 minute training.

So to stimulate the retina in specific ways in order to try and get enhanced vision. So that they can see better and for people who are losing their vision, and this is key for people that are losing their vision to not lose their vision. So, to hold on to what they've got because it's one thing to cure blindness, to reverse blindness, but in many blinding diseases, it's slow.

So like in glaucoma, it's really slow. And so we are making a serious effort. to halt their vision loss. And I can't it's a clinical trial, so I can't report the results of that. Yeah. I'm also blind. No pun intended. I'm also aware of the results in many cases in order to keep the science rigorous, but.

It's, you know, I'm excited about where it's going. I'll just say that. And, and of course the data where the data, but I really, I got to ask you about it. Yeah.

[00:34:56] **Dave Asprey:** Do you go home at night and put those VR goggles on to give yourself supervision?

[00:35:02] **Huberman:** No, but I've become very no, I don't do that. Were you hooking up?

Hook a brother up? Sure. I can, I can hook you up with the code and the stimulation is actually kind of fun. We have people forage through a virtual art gallery so you can learn art while you do this. You have to make this stuff interesting. If you're going to do something five times a week for 30 minutes, we had to make it interesting for the patient.

So we designed a virtual art gallery that the patients go into. They view these empty frames. which are boring, but then they see specific patterns of visual stimulation. And then as a reward for that, they then get exposed to different, they see these different paintings and they're learning the paintings.

And as they, and we're using that as a measure of their visual perceptual abilities too. So, yeah, I'd be happy to, to tell you what we're doing with it, supply you with the, with what we've got. We're, we're, You know, the VR technology has expanded so fast. I, I don't think VR is going to be one of these things that like is going to take over every industry like people predicted it would, but I think for clinical treatments it's extremely valuable.

[00:35:58] **Dave Asprey:** One of the things that fascinated me when I got really into my visual system was that My left eye would actually turn off so I would not see in stereo vision, but I didn't know it I was blind to the fact that this was happening. So my brain would get tired. My my visual system was stressed My eyes didn't team well so I worked really hard on turning that eye back on so that I would have both eyes work at the same time in really training the Brain to cause them to work together the theory that they that they came up with was that, well, I started reading when I was 18 months old, so I probably spent a lot of time staring at a page instead of looking at trees and crawling around and stuff.

[00:36:35] **Huberman:** Yeah. Well, absolutely.

[00:36:36] **Dave Asprey:** Yeah.

[00:36:37] **Huberman:** Wait, how old were you when you did this retraining?

[00:36:39] **Dave Asprey:** I was about, let's see probably 34, I guess, 33, 34.

[00:36:43] **Huberman:** So, I mean, that's an amazing story and it's awesome because, you know, the classic thing, the Human Weasel Nobel Prize was for this idea that the brain is plastic early on and then it's kind of frozen these critical periods.

But the work

[00:36:55] **Dave Asprey:** Eric Kandel came on the show, the guy who like discovered neuroplasticity, right, right, so. Oh,

[00:36:59] **Huberman:** yeah. No, I mean, I think that one of the great, you know, sequels to that was these people like Kandel, like, Eric Knudsen, like Mike Mersink, who've shown that, no, it's an absolute no. There If you, it's not just restricted to early life that if you pay attention to the tasks that you're focused on.

So this is getting the realm of adult plasticity. If you pay attention to the task and you have sufficient level of autonomic arousal or alertness. Right. Sympathetic arousal. Then the neuromodulators, dopamine and acetylcholine. Nicotinic receptors are stimulated by the acetylcholine. We can talk about nicotine, right?

You're a fan under certain regimes. Then you open up plasticity. You essentially amplify the conversation between particular neurons that are involved in that sensory event, like viewing something or conversation or whatever it is. And then you get Long term plastic changes in that circuitry and I think nowadays in 2019, it's absolutely clear that adult plasticity is not only possible, it's available, you just provided you engage in the particular learning bouts, they have to be short, they have to be focused, they have to be repeated, and it does help if there's some neuromodulator augmentation now, that's not for everybody, right?

Not, I, I personally, not everybody should be chewing Nicorad or whatever, but there are, right, but there are conditions in which that can potentially enhance plasticity as you know more about that topic than I do. But the plasticity in adulthood is very real and you're a really great example of that.

[00:38:31] **Dave Asprey:** I'm really interested because I'd love to put on a pair of virtual reality goggles and, like, have it overweight my left eye to, like, stress that part of my brain so it would become probably even better than it is, because I know that I have a perceptive weakness there.

And I imagine a substantial number of people have one eye that's a little bit weaker than others. We've had Helen Erlen on who talks about this stuff. So, I know we could do that with VR, and I'm hoping that you or some of your friends are doing that. But the flip side. I'm a computer hacker by background, by training and I think about what happens if you have malware running in VR goggles?

You know, can I change the flicker rate on just the left eye versus the right eye? I mean, could you like trash people without them really knowing it?

[00:39:14] **Huberman:** Yeah, I mean, if someone had ill intent, they could do that. Sure. I think That's actually

[00:39:18] **Dave Asprey:** kind of scary. I mean, if you're playing video games in VR for six hours a day and there's a 5 percent tweak between your two eyes.

Over time, that could be like a substantial performance improvement, and you would have no idea why.

[00:39:29] **Huberman:** Right. Well, I don't think anyone should be spending six hours a day in VR. I mean, Jeremy Bailenson, a colleague of mine here at Stanford, wrote he wrote this book, Experience on Demand. And is a sort of, he's been in the VR field essentially longer than anybody that I know.

And he he has some very specific prescriptions, especially for kids whose brains are very plastic. Yeah. There's, you know, look, one hour. Or two hours of a patched eye of just occluding or closing one eye in childhood can lead to a permanent shift. In the brain representation of that eye, you can become cortically blind to that eye unless you do the reverse experiment, which is to cover the other eye and open the one that was recently closed and reverse it.

That's the kind of work that Hubel and Wiesel won that Nobel for. So the rewiring that you can have in adulthood is more subtle in any one session, but that's why you don't want to be spending six hours a day in VR or I mean, it's not clear you should be doing six hours a day of any one thing in particular, except maybe sleep.

All right.

[00:40:25] **Dave Asprey:** There you go. I like that quote. What about we'll just call it human augmentation about going beyond what we were born with. You've, you've done your scuba, you've done some pretty extreme sports sorts of things over, over the years. What's your take on it? Is it, is it real? Is it happening already?

Is it going to happen? What does it look like?

[00:40:47] **Huberman:** It's going to happen. It's happening. You know that there are some people out there that are, you know, claiming they're going to, you know, put chips in the brain, get people learning languages in a few days, enhancing you know, here's the deal. At this point in the sort of history of neuroscience.

we understand a thing or two about sensation. The neurons involved that mediate sensation, a thing or two about perception, a thing or two about emotions, although emotions are very poorly understood for a thing or two about thoughts, although that's very poorly understood and action. And we know a thing or two about because you can measure it.

Right. Now, that means that, you know, what the brain is doing, the so called neural code is mysterious. So that there've been a lot of recordings from the brain, so called when people say reading the brain, you're sort of like, what are the signals? What are, how, when are the neurons active in space and time during a behavior or a thought, et cetera.

And then there's writing to the brain. There's actually manipulating the neurons and their activity. Well, we don't know what the algorithms are that lead to say, if I say, okay, you know, Have you ever had a pet, Dave?

[00:41:49] **Dave Asprey:** Oh, absolutely. I have a dachshund

[00:41:50] **Huberman:** named Merlin. Cool. So like just that conscious recollection of his name and his or her name and and the ideas of Merlin, there's so much context, right?

We don't really know what the, what the symphony of neuronal activation is for that such that we could manipulate it and change your relationship to it. The things that we're getting good at at neuros, as neuroscientists and as biohackers or, or whatever. are manipulating that arousal state. You know, I'm, I'm fascinated by all the stuff, all the concentration on breath work and ice baths and ketogenic diets.

These are all things really designed to manipulate arousal state. And then you've got the stuff that's more targeted at cognition per se, like do Trump X and things of that sort is really more your way, hostile mind. But I, I watched the field and I try and place it in neuroscience context. This, the people that are talking about creating super beings that can learn so much and retain so much.

You know, I, I invite a challenge. I'm delighted that people are thinking about neuroscience, but without any understanding of really how to think about emotions in a, in a rigorous scientific way, or think about thoughts in a rigorous scientific way to really understand what those are. I'm not all that confident that people know what sequences of stimulation to put into the brain in order to get it to be, you know, 10X better, 50X better, any one thing.

However, I will say this things like you mentioned TMS, there are laboratories that are now using 10 Hertz stimulation, not inhibition or inactivation, but activation, 10 Hertz activation of particular circuits to open up the window for plasticity.

[00:43:22] **Dave Asprey:** With magnets? Or electricity? With TMS. With TMS? Yeah.

Okay. So I, I have a neuroscience facility, not quite up to the Huberman Lab standard, but You know, we, we have two neuroscientists and a lot of EEG stuff, but we'll actually use very specific frequencies with an alternating current across the brain. Including 10 hertz is one of them, but we'll do that to increase neuroplasticity before doing neurofeedback so that you can get basically bet more results in less time, right?

And I've been doing that kind of stuff. Well, the alternating current for now going on 20 years in different, different frequency sets, but you're doing it with magnets, which we'll also use pulse magnets actually in those frequencies, but they're very weak compared to what you're talking about. I'm a little frustrated.

The Russians started doing this in the sixties. That's how come I know about it. It was from the Russian space program and it feels like transcranial stimulation. TDCS about eight years ago. I started blogging. I wrote a lot about how to do it yourself. I've sent it out in the quarterly curated box. I do.

And I look at that biohackers are doing that one thing, but we have 50 years of using electricity or, or in some cases, magnets on the brain, but it's almost unheard of. You got halo neuroscience out, maybe doing it. What did, why does it take 50 years for this stuff to come out? Do you have a sense from the inside of academia?

[00:44:39] **Huberman:** Yeah. So I think yeah, so there are people using 10 hertz stimulation trying to open up windows for plasticity. Yeah. It, you know, it can be done. Why? Okay. The reason is that failures at neurosurgery and in medicine can halt fields. So like, if you look at gene therapy, right, like there were some early failures that set back the field of this powerful thing of gene therapy, of using viruses to deliver genes that people need into their body and brain in different ways get set it back a decade or more.

You know, that there's, the medical community is very reactive, right? Like the fen fen thing, like people were losing weight and then a couple of people start dying. It's like gone. Right. Right. Right. Right. Right. So, tryptophan, right? You know, it's like now you can go buy 5 HTP or tryptophan at, at the, at your health food store online at Amazon.

But, you know, it used to be that because of a contaminated batch of tryptophan and some people died, it was like, tryptophan was off the market, you know? So people are relying on heavier sleep medication when they probably didn't need to. So there's a tragedy as a result of that. ban, right? Too. So I think people are reluctant, but it's changing.

I think that brain machine interface is going to be the first place. Non invent invasive brain machine interface.

[00:45:46] **Dave Asprey:** Can I high five you for that? So that noninvasive part of that if you're listening, There's the the Elon Musk neural lace idea where we're going to have these implants in our brains.

My wife, Dr. Lotta and I started a company that did a lab testing for immune rejection of implant materials that are supposed to be hypoallergenic and So we went kind of deep on that. This is in the mid 2000s And I'll tell you, there are people allergic to titanium, allergic to gold, things that you're not supposed to be able to.

And then you have biofilms and infection. And I'm pretty out there. I mean, I've had stem cells everywhere and done all sorts of stuff that swallowed electrical stimulation devices. I'm not implanting crap in my brain until we've managed to get all the signal out of our, uh, our eyes coming off our brain and there's just so much that's not touched.

It feels foolhardy and stupid and like you read too much sci fi which is almost impossible to do in order to think oh we got to drill holes and I feel like I'm almost almost like a heretic for saying that but but you you said non invasive before I did so why are you in the non invasive camp versus you know why shouldn't we all just go get a chip?

[00:46:52] **Huberman:** Well, I think as I'm realistic about what's going to, what most people are not going to breach the skull, they're not going to take a little drill skull, you know, neurosurgeons aren't afraid of drawing through his skull. They love it. They live for it. They train for it. And so they're the first people say, Oh, yeah, you know, it's no big deal, but they do it with with a purpose.

Now, I think that, You know, there is this portion of your central nervous system, the brain, right? The only piece of your brain that sits outside of your skull is your retina. And so I'm obviously, you know, I keep coming back to this, but I'm making a push for the, you, the visual system as an entry point for at least manipulating states.

And for accessing you know, the spirit of courage transition for accessing, you know, control over stress in real time. I'm not an engineer. I'm not developing the technologies to do this. One of the reasons I was excited to come on your podcast is because people listen to it. I think that there are smart people out there that can create science grounded tools for this.

And remember, that's a piece of the brain hanging out outside the skull for which the statistics. And the, in other words, the stuff you want to deliver to the retina, then I don't injecting into the retina. I mean, looking at stuff or seeing certain things is. It is kind of known. It's not like you have to go find some substance in the Amazon.

It's called light, you know, and you just have to manipulate light either in VR or in another format in intelligent ways, and I think that so that is one form of brain machine interface. Now, Halo is an interesting one, too. I think the founders of Halo, one of them trained with Mike Mersing. I've never tried the device, but

[00:48:21] **Dave Asprey:** they came, they came on the show is pretty cool.

Yeah.

[00:48:24] **Huberman:** Yeah. I mean, it's grounded in very good logic. I, I received nothing from them, but I, I think that the logic is great. Stimulate so called post synaptic activity, you know, activity in, in more cortex while engaging in a motor chassis, one learn better, get a little more or much more amplification of a signal and, you know, learn things faster.

It may, it all makes sense. I think that the stuff that you're doing of. you know, I haven't tried all the tools. I'd love to, next time I'm in San Monica, I'd love to try some of the tools and goodies, the pods and all this stuff. But I think very few people are willing to take an intelligent, thoughtful engineering approach to this.

You know, on the one hand, you've got scientists that are busy running their labs and trying to figure out how things work under normal conditions and solve disease and stuff. And then you've got people in the biohacking community with who are like, Well, what one pill is just going to get me there?

And I think I'm not just saying this because we're in conversation. I think embracing the brain machine, the noninvasive stuff, the supplementation stuff, the whole of it is the only way to arrive. It's a whole field. Right? It's like saying, the field of neuroscience couldn't have gotten by with just an electrode.

You also need anatomists and molecular biologists. The field of biohacking and wellness, you need people who are thinking about different domains of the problem. And, and you're doing that, and there are others, of course, too.

[00:49:38] **Dave Asprey:** You, you nailed it. When I, I created that that community and in the term, in fact, they added biohacking to the dictionary in 2018 in Merriam Webster's.

It's a new word in our language. Is his name in there? Yeah, it is. Are you serious? I'm serious. I was blown away. Someone texted me. The next thing

[00:49:54] **Huberman:** that I always say, the moment you become a verb, then you know. It's like Marie Kondo now, they're talking about like, You're going to Marie Kondo that. So pretty soon, you know, what are you, are we going to call it bulletproofing it?

No,

[00:50:03] **Dave Asprey:** it's, it's just called biohacking. And I, I actually, I didn't trademark that word because I wanted there to be a name for like, how do we bring neuroscientists and Navy SEALs and, you know, deep sea divers and weight loss experts. And, you know, all the people who didn't, oh, and bodybuilders for God's sake, like they would never talk to neuroscientists, but they're really.

really good hackers of our human biology and well, they're willing to try most anything. Yeah, we need guinea pigs who want to look like balloon animals. I'm just kidding. But you know, like if you want to get real swole, but I wanted that and you're, you just hit it on the head when you talk about you won't get there with just one because I used to try just one of those when I had a lot of work to do because I was pretty much wrecked and It kind of makes me mad when people are like it's just that one pill.

It's like, no, you can't eat garbage and take the one pill. It doesn't work, right? And if you just eat really cleanly and you think that's going to magically give you all the performance you can do, well, that's not going to work either. Like, you just have to stack it, but then it's actually work. And sometimes maybe you need more arousal so you'll be on fire to do the work.

[00:51:01] **Huberman:** You know, it's interesting because I think that right now we're at such a key point in the evolution of not just neuroscience, but this, this biohacking field. I think that it's no longer niche. And there are a number of scientists really, you know, I heard a great podcast that was with Rogan and David Sinclair on aging, you know?

Yeah.

[00:51:19] **Dave Asprey:** I've been following David Sinclair's work. Some of the. In fact, some of the people who have shown some new things about nicotinamide riboside that we're going to come on soon. So, yeah, okay. So,

[00:51:28] **Huberman:** yeah. Yeah, I mean, guys like Sinclair, he was willing to at least talk about what he's doing in his own life.

You know, he cares about his longevity and his health. You know, there's a new generation coming up and we're you I mean, I've been in this game a while because I got into it young, but, uh, you know, we, we want to live long, healthy, better lives. I, I, I approached neuroscience and my career in neuroscience.

I looked at, I was like, look, I'm not a professional athlete, but like, this is as competitive and time consuming and energetically demanding and potentially stressful as anything else. And it's professional. And this is my, my, my livelihood. So my nutrition, my supplementation, my exercise, my. Whatever brain machine interface stuff I happen to play with a lot I've done less of that was all geared toward trying to be better what I do right and live my normal life outside the lab But but so I biohacked my way through neuroscience like that Yeah

[00:52:17] **Dave Asprey:** That's that's why you know You have a position at Stanford because the and that came out really well in game changers this last book I asked 450 people who did something noteworthy enough to be on the show the same question You and found the common patterns of what they did to, to become preeminent at what they do.

And well, what you did to become at the top of your field is, is very similar. Like there, there's common patterns. And one of them is in fact, the number one answer out of all these interviews, when I had a statistician go through the data with me, it was actually food. Like, and a surprising number of people realize that when they eat crap, they just don't perform well at, at all.

at what they love to do, and then they don't. But then it, from there, it goes all over the place which is, which is fascinating. So you, you somehow knew that. And I have two more questions for you. One is, how did you know to do that? Like, did you have weird parents who were, you know, hippies giving you, you know, drops of herbs?

Did you have, like, that's a rare human thing to just evolve into.

[00:53:16] **Huberman:** Yeah. Honestly, it was, it was because of a girl.

[00:53:19] **Dave Asprey:** It always is.

[00:53:21] **Huberman:** It was. I mean, the short story of it is, you know, I was kid in high school, like skinny skateboard kid. And I love, and I was, you know, there was a girl a couple of years older than I was.

And I heard I might have a chance or like, she might've looked in my direction for a millisecond or something. You know, I fell in love young, followed her off to college. And I, and I, so I got into fitness first, you know, I was like, all right, I'm going to start doing my pushups and sit ups and that kind of thing.

And then, you know, You get into that community and pretty soon you discover like, oh, how I eat impacts my body and how I feel and how I think as well. And over time I got really interested in nutrition supplementation. I always wanted to try out different things. I, you know, I found I do bet best personally on like limiting my starches and eating more fats.

I was lucky that my dad is Argentine. So he was always like, he was always like, look, you, you know, you want to eat meat cause it's important. Like, you know, this was in the nineties, right? Cause it was on these loaf. So, and I felt like I could outwork people like in terms of longevity, like in time, everyone else was crapping out and I'm still going.

And then I could use, I learned pretty early to use exercise to change my schedule. So if I need to be alert in the morning, I start exercising in the morning. I can shift on jet lag that way. And so I started biohacking early on and frankly, I loved supplements. I think it taught me to be in tune with my body.

I'm very sensitive. So how many a day do you take? Oh man. So the joke, okay. Among my friends and colleagues is when people say, what do you take? My response is just all of them. I, I have the things that I take. If you looked at what I take that most of you're kind of

[00:54:51] **Dave Asprey:** thinking, like, it's going to be number because I do 150 pills a day.

So that would be the rest of the show

[00:54:57] **Huberman:** somewhere in that regime. Okay. But

[00:54:59] **Dave Asprey:** you take fistfuls basically.

[00:55:01] **Huberman:** Oh, yeah. I mean, right. I mean, yeah, this falls easily and, and I'm a big fan of, but I'm very systematic. So I've got my stack. I'm always happy to share that with people, but that's just what I do. I, I've got my, my stack and then I systematically try new, new things.

And, and I can tell very quickly if something doesn't work for me or works for me, everything I get, you can get off Amazon. It was like typical. And so I don't take anything really esoteric, but I've long taken things like desiccated beef liver tablets. Oh yeah. Me too. For years. I mean multivitamin, ginger, these kinds of like, but you know, so I eat pretty normally except pretty clean.

But you know, I think in general the supplementation has given me, I would say it's hard to put a real number on this, but anywhere from like a 10 to 25 percent advantage in terms of, you know, I just, All and like intentionally they're dropping out. Yeah. Or like I see them later like on for a meeting.

I don't mean here at Stanford 'cause there's some superpower people here, but Of course, but like on for the meeting and then you walk away and they're kinda like, oh, you see them five years later. You haven't seen someone in like a year. Mm-Hmm. You see 'em in, you're like, what happened? You know, they're like falling apart.

They're talking about their, their this pain and that pain. I'm like, I'm 43 now, and I, I don't. I put time and energy into it, but I think it, it makes me happier and it makes me better for my work.

[00:56:16] **Dave Asprey:** Oh, the ROI on that is, is exceptionally high. And there's an infinite number of things you could do that would take all of your time.

But over the course of practicing them, you figure out this one was worth it and this one wasn't. And that's the path of biohacking. All right. Final question for you. I've been running an anti aging nonprofit group, actually one that meets in Palo Alto for almost 20 years. And I've learned from people, you know, three times my age, at least, well, back then, three times my age now, I was getting up there.

But I've been real public in men's health recently, I was like, look, I'm going to live to at least 180. I, I, here's the math, here's why I think I can do it. And that's pretty far out there. But you're a biohacker, you're a neuroscientist, you're very well trained, you know what's going on up there. How long are you going to live?

It's a really interesting question.

[00:57:05] **Huberman:** I actually believe, and I've felt this for some time, that two things. One is that we have a kind of intrinsic sense of how long that is without any intervention. I think we can sense it, although we have family history. So that gets in the way. I have a theory and I'm, I am not, this is not grounded in any data that I've ever collected, but I have a theory.

how protracted or prolonged your puberty was is a good predictor of your longevity. And now probably someone out there is like, so and so said that 20 years ago. Okay. Yeah. I, yeah, I get it. I haven't read the literature. I haven't pub medded this or in detail, right? Usually take a look every once in a while.

You know, the men in my family have they age slowly. I you know, I have to read it like, you know, 14 like most, like many kids at that age, but my, it was very protracted in terms of the acquisition of what they call secondary sex characteristics. Right. And I think that Right now I'm, I'm aiming for 100, but the key, but I'm willing to expand that out.

But this year on my birthday, I went up to clouds rest, this peak up in Yosemite, did my, my age and pushups. And I plan to do that every year. I'm determined to prove that you can get better every single year. Cause I feel better. You can, like you can get younger. It's totally, I literally feel better and I can perform it every single year.

And I think there. There are levers to make that go better, of course, and you know more about that than I do. But just to be optimistic, I'm going to say 120, and All right, you just added 20 years right there. All right, that's what I like to hear. Well, yeah, 120 because I feel that 100 is without intervention.

There you go. Okay, 100 without intervention. And I'm gauging that on a, I believe that we have clocks that allow us to get some sense of our, of how long we've got to go barring accident or injury. Of course. Right. Right. Plus doesn't care about your genetics, right? You still on bus, you're done. So, if it's moving the, so the, but the, And I'm not suggesting you want to do that, of course, the opposite.

But I think that the, the, I think we have a sense of our, of our arc. And I think the duration of puberty and the acquisition of the speed of acquisition of secondary sex characteristics is a interesting potential predictor of that arc.

[00:59:28] **Dave Asprey:** Andrew, thank you for for your work. You're doing really fascinating stuff across a diverse spectrum of neuroscience and neurobiology.

And for, for people listening, you've got to check him out on Instagram. He has one minute neuroscience lectures. It's at Huberman lab is where that, that stuff is. And I, I really appreciate both the depth of his work, but also the fact that you're, you take the time and that you have the. Ability to share it in a coherent manner because there are a few neuroscientists probably some guys you and I both know who are doing profound work and they can't tell you what they're doing because they just, you know, they don't have that in.

So, so just thanks for being a good storyteller about your work and just for doing the actual hard stuff that you do.

[01:00:08] **Huberman:** Well, thanks so much for the kind words and for hosting me. I'm a huge fan of the work that you've been doing and are doing. And it's really, for me, it's very gratifying to get a chance to talk about these ideas with you and share them with your audience.

So thanks ever so much.

[01:00:24] **Dave Asprey:** See you next time on the human upgrade podcast.