Introduction to Fatigue and Energy

So all of us are tired. We can say that I'm tired every day. I started to learn a little bit more about it. But fatigue, Which is literally fatiguing us as a society, is misunderstood.

Are you witness? Been working on this for some time? He's going to help us understand it better. At the root cause level, you know, a lot of us try and math things and take things as stimulus to stimulate ourselves.

Like, hey, that coffee is going to fix it. But it's there's more than that going on. And so, first of all, thanks for joining us. Yeah. My pleasure. Thanks for having me.

And I think I of all the things that we're going to be talking about, this is one where like everybody eats and know because we all have our days or our weeks or months, we're just not going.

Right. And what we think our, you know, my energy or my coffee intake or whatever is not aligned, but really this we're talking about going right down to the cellular level. What the mitochondria.

So, you know, how does how do we look at sort of mitochondria and the brain. And I know this is what you often talk about as the two sources for like, here's why we where we got to start when it comes to fatigue and energy.

So the the brain piece is maybe a bit more straightforward. Okay. So we'll start there. One of the key principles to understand when it comes to how the brain regulates our energy levels is something called sickness behavior.

And this is a are you familiar with that phrase? I've heard that. Yeah, yeah. Okay. So it's, it's a it's sort of it's, a well-established phrase. There's a lot of scientific literature about it.

If someone's going to go on PubMed or Google Scholar, you can look it up and it's basically fatigue and lethargy and lack of motivation and kind of a depressed mood and apathy and, and those kinds of things and a number of other related symptoms, that happen when the brain is detecting high levels of inflammatory cytokines, right.

In the system. Okay. And that can be the result of, pathogen and infection, like a flu or Covid or something like that. It can also be the result of an injury.

So if you got a sprained ankle or, you know, I make my dog. The other day, I came home from surfing and my dog was laying in the driveway, and I knew immediately something was wrong because normally she's running up to the car like super excited, barking.

And she was just sitting there looking at me and I went, oh no, she got hurt. And sure enough, she she, did something to her foot. Nobody was around when it happened, but she I got it caught in some branches or maybe got stung by a scorpion or something like that.

We're not sure what what happened, but she injured a foot somehow, and she was moping around the house all day, just laying there depressed and not wanting to move.

And guess what? Those are classic sickness behaviors. Symptoms. Why? You know, why did her mood change or energy level change? All these things change because she injured her foot.

And it's because the high, the high levels of inflammatory cytokines, were influencing her brain to regulate all these different things that are downstream of that.

So, you know, this is why people, when they get a flu or they get a severe sickness or Covid, this is why you're in

bed or my wife's got food poisoning a couple of days ago. She's puking.

And super high levels of inflammation from all those bacterial toxins entering your bloodstream. Guess what? Laying in bed fatigue doesn't don't want to move.

Depress mood, right? That's sickness behavior. And that is happening to some degree in most people because most of us have ubiquitous things in our lifestyle that are causing elevated levels of inflammatory cytokines, things like exposure to environmental toxicants, things like, sleep, not enough sleep, sleep deprivation, things like psychological stress, things like poor diet and things like, being overweight.

Sickness Behavior and Inflammation

It turns out just carrying excess body fat actually produces high levels of inflammatory cytokines all the time. And if your brain is sensing high levels of inflammatory cytokines due to the presence of, you know, high levels of excess body fat, it's going to respond to that in much the same way it does if you have inflammatory cytokines due to food poisoning or Covid or a flu or whatever, or an injury.

Right. So inflammatory cytokines are perceived by the brain in a way where it lowers energy levels. So that's one key layer of of the energy story. That's important for many people.

But the biggest one is mitochondria. And mitochondria are an interesting aspect of this story because on the one hand it's very straightforward. Mitochondria are our energy producers.

So it makes sense that they should have a big role to play when it comes to our overall energy levels. And they do. However, the story is more complex than most people are aware of.

Most people think of mitochondria in the way that we were kind of taught in high school and college biology classes, where it's like mitochondria are the powerhouse of the cell, quote unquote.

And we kind of learn to think about them as these sort of mindless energy generators that just take in carbs and fats and pump out, ATP, adenosine triphosphate, or cellular energy.

And they do do that. And that their role as the powerhouse of the cell or the energy generator is incredibly important. But it turns out that they have another role that is as important and that most people have no idea about.

And because it's only been very recently discovered in the last 5 or 10 years, which is their role as environmental sensors. So it turns out that mitochondria are like canaries in the coal mine, and they are the sensors that are constantly taking samples of what's going on and around the cell, what's going on in the bloodstream.

And they're taking samples, testing that environment to determine is there any danger present, is there any stressor that we need to be aware of? And as soon as they detect the presence of a significant amount of stressor, they shut energy production down, okay.

They turn it down and they shift resources into defense mode or what? The researcher, the primary researcher who's responsible for uncovering most of this, doctor Robert Navajo, who runs a lab for mitochondrial medicine at the University of California, San Diego.

He he calls it the cell danger response. And okay or CDR for short. And it turns out basically mitochondria have these dual roles and they are two sides of the same coin.

So they're mutually exclusive to the extent that mitochondria are switched into defense mode because they are detecting the presence of stressors or dangers, they turn down the dial on energy production.

So from this paradigm, you can you can think of your overall energy levels, whether you're highly energetic, you know, bouncing off the walls like a little kid, like my five year old and two year old are all day, except for nap time.

Or you are an older person who's struggling to get through the day because you don't have much energy, right? Or you're somebody who's debilitated with severe chronic fatigue in bed.

You can barely move, barely function, severe brain fog. You know, everything's kind of shutting down. Okay. These are these are different. Places on this spectrum from mitochondria being unlocked into full on energy mode to mitochondria being fully shut down into full blown defense mode.

Yeah. That's awesome because most people first of all the way you put an image is so easy to understand because I've, I've spoken about this before. Even within the summit we had another conversation that touched on this.

And it's just so clear and eloquent the way you describe it. Then all of a sudden, if this science is kind of new, meaning that you know it, some other people know it, people don't think of the mitochondria in this way, and they're targeting the energy production only.

Does that mean that the solutions are using our mismatch are not going to be helpful, because there's so much else going on. Yeah. Well, Here's, here's maybe, an analogy largely, largely appropriate.

Let's imagine I was hitting your toe with a hammer, and I was just smashing it. And every day you wake up and I say, you know, Kashif, come over here, and I smash your big toe with a hammer ten times, right?

Okay. And then you're conceptualizing that problem as man, I really feel pain. I feel a lot of pain in my toe. It must be because of, you know, these iconic swords and the high levels of inflammatory cytokines and the nociceptors, they're triggering this no perception region of my brain that's triggering this feeling of pain.

So if I just take these pharmaceuticals, these maybe if I take some, anti-inflammatories and I can reduce the, the inflammatory cytokines or I can take some, some morphine or opioids that decrease the activity of the pain, regions of my brain, pain sensing regions of my brain.

Boom. Problem solved. Right. Okay. Right. But that's not actually solving the problem, right? Because I'm still smashing your toe with a hammer every day, right?

To solve the problem, you need to stop me from smashing your toe with a hammer every day. Not not to take drugs that cover up your sensation of pain. Yeah, right.

Yeah. So I'm asking is where any. Sorry, but. Yeah. So we need to solve problems at at the root cause level and figure out what is the real source of this problem and solve it there.

Yeah. And this is the misconception of what illness or disease is, because sometimes the root cause in the way you describe is completely counterintuitive or unrelated to the symptom.

Right? So pain isn't a disease. Pain is your body telling you there's something wrong. You just start investigating. Right. But investigation usually ends, right?

Can you please get rid of the pain? Yeah. Why? What's the point of your body trying to communicate with you? So that's where. Yeah. You got to dive deeper because ultimately, do you want to be managing the pain or eliminating you as you're figuring out what's actually going on. Right.

Right. Yeah. My, my my brother's a chiropractor, pain specialist. And, he, he talks about he gives a he likes to give an analogy where he talks about, like, you get into your car and you check engine light is on because you haven't changed the oil in three years.

And you know, the way to solve that problem isn't to ask a mechanic to turn off the little light that's in the sound that's beeping, that's saying, check your engine, replace the oil.

You know, it's to replace the oil, you know, and fix the problem. Exactly. Yeah. I just we just need, to meet people that are better equipped to understand what that like, means, you know?

Exactly, I guess, and just looking at that, the tools that are provided in conventional medicine, I mean, they're symptom masking tools. So how do you then work with somebody that understands?

I mean, it's awesome that you're sharing this knowledge today and people will learn a little bit and maybe it'll resonate with, oh, that's what's actually going on.

Mitochondria as Energy Regulators

Right. But in general, the solution is go to the doctor and get a conventional medication. So essentially you're saying that that stuff's not really going to help you.

It's only going to mask the light. Yeah. Well let's let's talk specific. So there was there was a paper published maybe eight years ago, something like that, called fatigue and overview.

And it was a paper published in the journal of the American Family Physician. And it was not an individual study. It was a compilation of the body of, of research to form a set of evidence based guidelines with their calling, evidence based guidelines, for conventional doctors of how they should treat their patients with fatigue.

And basically they said, there's four treatments that you can offer your patients with fatigue. One is a recommendation to, walk for 30 minutes a day.

Another one is cognitive behavioral therapy. And then antidepressants and stimulant pills as needed for those. Those are the four things that conventional medicine offers to treat people with fatigue.

And I mean, that's it. So notice I didn't even mention anything about nutrition. Like, you could you could have a patient who goes to a doctor with complaining of chronic fatigue, and that patient may eat nothing but, pizza and Krispy Kreme and McDonald's every day.

And that doctor wouldn't even analyze their diet or connect the dots to to say, you know, maybe your diet has something to do with this because it isn't.

Nutrition isn't even written about in their evidence based guidelines. So, and nutrition is obviously one of the biggest contributors to chronic fatigue.

One of the other biggest contributors is, of course, sleep and circadian rhythm issues. Massive contributor. So anyway, that that's, you know, conventional medicine doesn't, doesn't have much to offer, even in the food paradigm, like, we look at, okay, what am I eating?

The pizza, for example, you know, well, I, I'm Italian and for ten generations, this is what my ancestors did. So it should be fine. Yeah, but pretend in generations they weren't getting it from Pizza Hut right then. The actual raw ingredients.

An example. We have a patient that we were dealing with who says that? Why is it that in Toronto, where we are I can't eat bread, but in London, England, I have no problem, right.

Because in London, England, the chemical that uses a drying agent to store the wheat and put it in a grain silo during our Canadian winter is illegal because it's so toxic, right?

So the ability for him to actually clear that toxin, there's a gene called, GST one, which literally is a police force in the blood and goes out and binds and finds these toxins, send them delivery.

He did not. He doesn't have that gene missing. Right. GST, one is the same thing of the gut. He had one of two

copies of 50% capacity. So all of a sudden you wonder why his friends have no problem going and getting a burger and having a piece of white bread, but he just can't do it.

He used to get joint pain. Brain fog and fatigue. Right? He was drained whenever he would eat bread. And now you understand what was actually going on.

So, the other layer that I know you speak of is, adrenals and and how that sort of leads to fatigue. So how are we thinking about that, right or wrong?

You know, mostly wrong. So, you know, I, a lot of my mentors in the natural health functional medicine space talked a lot about adrenal fatigue. I kind of grew up reading a ton about it, and, and, I was convinced that the whole thing was, was very true and very important.

And I was so convinced of that that at one point I wanted to write a book on the subject, because I was so irked by the fact that conventional medicine brushes off the whole thing of adrenal fatigue as pseudoscience and nonsense.

Yeah, I was so irked by that that I said, you know what? I'm going to I'm going to stick it to you guys. I'm going to prove that adrenal fatigue is a real thing, and I'm going to dig into this literature and find out the truth and write a book on it.

And, you know, I went on PubMed and I put in adrenal fatigue, and I was first, you know, like first day I went to try to do this, and I was shocked by the fact that almost nothing came up.

Well, it was literally almost zero result. And this is for people who don't know. This is unusual because, I mean, even if you thought of the most obscure disease that you can imagine, like Cline Selter syndrome or, Ehlers-Danlos syndrome, or like just some random rare genetic disorder or any obscure disease you can think of if you go to PubMed or Google Scholar and look it up, you know you're likely to find at least dozens, if not hundreds or thousands of studies on it.

Right? And so adrenal fatigue has been around for like 20 years, you know, that people have been talking about this and, you know, dozens of books have been written about it.

There's a million articles online, million videos online about it. You'd think that you'd find at least a few dozen studies on it. But nope. Like nothing.

So this was kind of odd to me. Yeah. And then to make a very long story short, I ended up spending about a full year of my life dedicated entirely to digging into the literature on this subject.

Because first of all, there was nothing that comes up with adrenal fatigue. So then I had to figure out, okay, what what can't what can I find literature on what what is relevant to this?

So then I figured out, okay, what if I look, chronic fatigue syndrome and adrenal function and or cortisol or HPA axis function, hypothalamic pituitary adrenal function.

Oh, now there's some studies that come up. Okay. What about what what are some other names for fatigue syndromes. Oh, it turns out there's some other names for different kinds of fatigue syndrome.

There's burnout syndrome. There's clinical burnout. There's, vital exhaustion. There's stress related exhaustion disorder. Right. It turns out there's all these other names for these burnout or fatigue syndromes that just that the don't go by the name adrenal fatigue.

And if you look up those and it took me I'm summarizing this all in matter of like 30s. But this took me weeks and weeks to discover even just one new term that exists, because you can't just look for it by name if you don't know exists, you have to discover somehow it exists.

So I start uncovering all these other terms that have been researched, and there is evidence on stress related exhaustion disorder and cortisol levels, or adrenal function, or HPA axis function and chronic fatigue syndrome and burnout syndrome and clinical burnout.

And, so then I start digging into all that literature and fibromyalgia and all these. So it turns out that there was a body of literature, on all these other things where they're essentially explicitly looking at the hypothesis of the adrenal fatigue hypothesis, which is basically for people who don't know, is basically the idea that cortisol is this really important stress hormone, a hormone that we produce in response to stress.

It's involved in some things related to energy production, like managing blood glucose levels, and in response to stress and things like that, sort of unlocking, glycogen from muscles and liver to be released into the bloodstream.

So there's some logical relationship to, to energy levels. So it makes some sense. Okay. And the adrenal fatigue idea is that that system is meant only to respond really to acute stressors.

But with chronic stress, it sort of taxes the adrenal glands to produce this hormone cortisol and taxes and taxes and taxes them. And then it just they just sort of wear out and then they don't have, they're not able to produce enough cortisol.

And then you get fatigue as a result of that. The so the, the way that you test this, this hypothesis to see if it is legitimate is very, very straightforward.

Take a group of people with chronic fatigue and take a group of people of the same ages and gender and body composition and, you know, control for all the confounding variables like smoking and exercise habits and yada yada, yada.

And check if there's a difference in adrenal function and cortisol levels between the people with chronic fatigue and the people who are normal, healthy people.

Yeah, it's very straightforward. People can try to make this very complex. But this the reality is this is a totally accurate and legitimate way of assessing the validity of this hypothesis.

And it turns out that there's a whole bunch of studies, dozens of studies on different chronic fatigue syndrome, burnout, stress related exhaustion disorder, all those ones I mentioned, chronic fatigue syndrome, etc.

and where they look at all kinds of different measures of cortisol levels and, they look at it in the saliva, they look, you know, 24 hours, they look at blood levels, they look at, what's called dexamethasone suppression test and how responsive the HPA axis system is to, to, certain hormones and how much cortisol is produced.

But the majority of them basically just do as I described before, take a group of people with fatigue syndrome, take a group of normal, healthy people, see if there's any difference in cortisol levels or adrenal function.

It's very straightforward.

Why Conventional Fatigue Treatments Fall Short

And, of the roughly 70 studies that have been done over the last 25 years on all of those topics. And, keep in mind, I'm condensing about a year of my life here in the span of a few minutes.

Of the 70 studies that have been done, about 15 of them found slightly lower cortisol levels in the morning in the people with fatigue, compared to normal, healthy people.

About 11 of those studies found the exact opposite. Finding where they had slightly higher levels of of cortisol in the mornings compared to normal healthy people.

And 33 of the 69 total studies. 59 total studies. Excuse me, I'm including, literature reviews, 33 of the 59 studies. The vast majority of them found no discernible difference whatsoever in cortisol levels between people with full blown chronic fatigue syndrome or burnout syndrome, or clinical burnout or stress related exhaustion disorder.

And, normal healthy people. So in other words, you know, there's lots of practitioners out there, naturopaths and other kinds of doctors who are big proponents of adrenal fatigue.

If I was to take, 100, lab results of cortisol testing, you know, from one 100 different people and put those 100 papers in front of, a doctor who is a full proponent and believer in adrenal fatigue.

And I said, tell me which of these 50 people have fatigue and which of these 50 are normal, healthy people with no fatigue. They would be as effective at doing that roughly, as flipping a coin.

That's their odds of getting it right. Yeah. Wow. So that's where I mean, you know, on one end, we, it when you're trying to personalize root cause medicine, the anecdotal studies actually are powerful because somebody says, I felt better.

So figure out why. Right now the clinical studies are typically, you know, we call them evidence based, but really they're more around safety as opposed to efficacy. Right.

It's like our own. How do you build something to make sure that this thing we have a theory around is safe? It is not going to kill people. Right. So the anecdotal studies typically work, but when you have enough anecdotes, that's when you kind of started to distill what's actually, you know, in trends.

True. Which it seems like you've done. Right. So that's that's awesome to see that that takes us back to, well, then what was actually going on with these people, they were solving the wrong problem.

And what are they actually to solve? Well, let's get back to the mitochondria. So what then? You know, if you if you're saying that there's more going on in the mitochondria than we think, right.

Which means that the solutions that we probably have that are conventional maybe aren't enough, what should we actually be doing? What is the solution?

If you think that this is one of the main sources that people should look at. Well, the main thing to sort of to summarize everything I've said so far, the main thing to understand is that the the focus on the adrenals has been overblown.

Right. And they're much less important. And cortisol is much, much less important than many people have claimed. It is in the fatigue story and that trying to focus your efforts on fixing your adrenals is not a good approach.

The big thing that you should focus on is your mitochondria. And the thing to understand about mitochondria is they are the primary regulators of our energy levels.

Okay, okay. So there are many different mechanisms in the body that are in one way or another, involved in some capacity, one capacity or another indirectly, with energy production like thyroid hormone, testosterone, dopamine and serotonin.

Gaba, orexin, insulin, you know, like many, many, many different things that you could make a case for cortisol that that have some relationship to energy production.

And that's legitimate. But what is the big thing that's regulating energy levels? That's really the most upstream. That is deciding whether the body should be producing lots of energy or not, a lot of energy.

And the main thing that's doing that is the mitochondria. They are, in the words of Doctor Robert Navajo, the central hub of the wheel of metabolism. And the way that they're deciding that, again, is to the extent that they are sensing

stressors in the environment.

Okay, stressors that exceed what I call their resilience threshold so that exceed their capacity to deal with that stressor. And as soon as you have stressors present that have exceeded the capacity of mitochondria to to deal with that stressor while staying in energy mode, if you've exceeded that resilience threshold, now they're turning out of energy mode and shifting into defense mode.

Okay. So there's there's two key layers to this story from this way of understanding things. One is the stressors that are present in that individual's lifestyle and environment okay.

So this is where we identify things like what is their diet look like? What are their sleep and circadian rhythm habits look like. How much psychological stress are they under?

What are their their habits with regards to managing that psychological stress? What are their their, what are their, environmental toxicant exposures like, and what are their mitigation strategies?

Do they have anything in their lifestyle that's dealing with, these environmental toxicants? Are they going in the sauna or are they sweating during exercise?

Are they, drinking pure water? Are they using any sort of, you know, are they eating vegetables to ramp up detoxification pathways, using supplements to support.

The Adrenal Fatigue Debate

Right. All these kinds of things. We we look at the stressors in their lifestyle. That's one layer of the story. And the other key layer of this story is what's going on internally at the cellular level.

That's determining their resilience threshold. And that primarily is a function of their mitochondria, their mitochondrial size and number. So in other words, do you have cells that are filled with lots of mitochondria that are big and strong mitochondria.

Or do you have cells filled with or not even filled with, but that have very few weak, shriveled, damaged mitochondria and not very many of them. Right.

And the difference between those two things is vitally important to understand. So let me phrase it this way. We know from research that between the ages of 20 to 70, most people lose about 75% of their mitochondrial capacity.

Okay. Which is a huge number. So if you're 70 years old, most people who are 70 have about 25% of the mitochondrial capacity of a young person. Now, you might be thinking in response to that, well, that sucks that we lose, you know, that that through just the natural aging process that we lose so much of our mitochondria in our cells.

Well, here's the key. It's not a natural product of aging. It's actually the result of lack of hermetic stress in our lifestyle or medic stress is, types of stressors that are transient metabolic stressors that stimulate our cells in our mitochondria to grow bigger and stronger and ultimately create beneficial adaptations that, make us more resilient and resistant to a broad range of other stressors and resistant to many diseases, and extend our lifespan and, so it turns out that the reason we know this is not just a natural, byproduct of the aging process is because if you look at 70 year olds who are engaged in regular exercise, who are lifelong athletes, they do not have 25% of the capacity of a young person.

They have roughly the same mitochondrial capacity as a young person. So it turns out this is not a loss of mitochondria. That's from aging. It's a loss of mitochondria.

That's a that's from lack of hermetic stress built into your lifestyle. And hermetic stressors are things like exercise and all the subtypes of exercise, things like breath holding practices, heat, cold, fasting, different kinds of

phytochemicals and certain kinds of light, UV light, read in near infrared light, things like that.

But, certainly exercise heat and cold and breath holding practices and fasting are huge, huge, very, very important traumatic stressors. And in the modern lifestyle, we live basically an anti war medic lifestyle.

We eat, highly processed diet devoid of these were medic phytochemicals. We're mostly sedentary. We have very long feeding windows and almost never engage in lengthy fasting.

We don't regularly engage in breath holding types of practices. We are living most of our lives in climate controlled indoor environments. And so we're not being regularly exposed to the elements of extreme heat and extreme cold.

And, because of the lack of hermetic stress in our lives, our bodies become weak and our bodies become fragile. And we our resilience threshold goes down because the mitochondria, by virtue of not being stimulated or challenged, are literally shriveling up and even dying off.

And the way to think about this is if you've ever broken a bone, if you've ever broken an arm or a leg and you had a cast on for six weeks or eight weeks, what happens after you get that cast off?

You look down at your arm or your leg and it's half the size of the other one, and it's because those muscles literally shrunk and atrophied, to half the size of the other of the other side in the span of less than two months.

So this same exact process happens internally at the cellular level with our mitochondria. If you don't challenge them with hermetic stress, they shrink and they shrivel and they die off.

And that's the reason that people lose most of their mitochondrial capacity as they age. And as your mitochondrial capacity shrinks, your resilience threshold goes down.

And now the stressors of life are your your body becomes much more fragile and sensitive, such that stress that you're exposed to, whether it's from pathogens, whether it's from psychological stress, whether it's from exposure to environmental toxicants or sleep deprivation or physical overexertion or whatever it is, poor diet, etc.

you can now overwhelm those mitochondria much more easily and shift them out of energy mode into defense mode. And this is why it's really rare to see a child with chronic fatigue.

But it's pretty common for older people to be fatigued, right? It's because of the loss of of mitochondria, the loss of the resilience threshold, and the fragile sizing of the cells of our bodies at the cellular level, at the mitochondria level, through loss of wear, medic stress, lack of war stress to the way you described it is, just mirrors so many other things that we know about the body that is lost in terms of its resilience.

Right? We are not designed to be weak, and victims were designed to fight back. Right. And we just don't know what we're fighting back against and meaning that if there's nothing to fight, body says, okay, fine, I'll just take a break.

Right now the atrophy sits and, just the atrophy at the cellular level. The beautiful way you described it just takes longer than a muscle. So it's really about, you know, your your body, just like you go rip that muscle and tear it and build it up.

Everything in your body requires that, right? If there's nothing to fight, what? What's the purpose of being strong? So your body will just take a break, right?

So for anyone that's gone beyond this, like, you know, they're hearing you now today and they're already 75 and they didn't spend the last 75 years training.

Is there anything you can do to reverse or mitigate sort of the damage has been done? Yeah. Great question. So, the reverse is also true. So the body can engage just just as we can have mitochondrial atrophy.

Right. And loss of might. Okay. Andrea, you can actually there is a reverse of that process. And we can stimulate the growth of mitochondria. And we can also stimulate a process called mitochondrial biogenesis, the creation of new mitochondria from scratch.

And we do that through or medic stress. That's the primary means through which we can grow our mitochondria bigger and stronger and create more of them.

So by engaging regularly in a regimen of exercise, various types of exercise, breath holding practices, heat exposure, cold exposure, you don't have to do all of these, but at least a couple of them regularly, will create widespread adaptations in different systems of the body, that create these beneficial adaptations to grow your mitochondria and create more of them.

So yes, you can absolutely reverse them. And, and each one of these types of rheumatic stress has, has its own sort of physiological fingerprint of the unique adaptations.

It's stimulating even within the category of exercise. Different types of exercise stimulate adaptations differently in the body. So, steady state endurance activities different from weight training is different from high intensity interval training or sprint interval training.

And that, you know, and then breath hold practices are different from heat exposure, are different from cold exposure. So there are certain universals of how these things operate when they converge on stimulating mitochondrial growth up regulating the internal antioxidant system to make make you more resilient at the cellular level.

But, for example, breath holding practices have you stimulate unique adaptations with regards to enhancing lung mitochondria and enhancing the actually altering the structural interface, the physical interface between the lungs and the bloodstream to be able to extract oxygen, more efficiently into the bloodstream.

And then you also get unique adaptations for dealing with low oxygen states. The cells in the mitochondria become uniquely adapted to low oxygen states and become hyper efficient at extracting oxygen to, to utilize it to produce energy.

So those adaptations are kind of specific to, breath holding practices and are different from, let's say, sauna exposure. And sauna exposure gives its own unique profile of the benefits that it creates, which are also amazing and wonderful.

So, having some variety of different types of wear, medic stress can build mitochondria and resilience into your system. In, in their own unique ways, in different, systems of the body.

That's truly awesome to hear because all of a sudden it's like you can create this menu of items that, stimulated in different ways and turn these different dials, but they're all because they're converging to this better version of yourself.

And, so in that, you know, so do you think about guys like Wim Hof and why he just can't get sick, you know, going out in the cold all the time and doing his breath work etc..

You think about these yogis that do their breath work and they're 100 years old and look like they're 35, you know, so, you know, what we just talked about is you can reverse, mitigate, bring things back, you know, bring on the stress and it comes back.

Energy levels go up because all of a sudden the mitochondria is like populated and dense. You also talked about mitochondria. You know, it's second job that most people are unaware of, which is that signaling that environmental signaling.

So do you end up with this? It sounds like a compound effect where all of a sudden your centers are a lot more

sensitive and alert and, you know, able to not only the energy levels go up, but your sensorial relationship environmentally is also better and stronger now because the centers are also more dense.

It's an interesting idea. I would frame it differently than that. Okay. The way I think of it is that when your mitochondria are weak, those environmental sensors become hyperactive.

Hypersensitive. Okay, so every little threat becomes overwhelming to them. Let me present like, another way of understanding this, let's say we have, like, let's say you and I, let's imagine we were here together on my property, and I've got a bunch of big boulders up there on my land.

Right. That we need to move. Okay. Is it is it more beneficial for for us to do it? Just you and me. Or if we call ten other guys to help us, which is going to be easier.

Having having the ten other guys. Right. So mitochondria are the same way.

Mitochondrial Stress, Aging, and Resilience

So the bigger and stronger the mitochondria are and the more of them that we have then accomplishing a given amount of work, let's say moving these 20 big boulders from one side of the land to the other is way easier with more guys with more mitochondria than it is with fewer mitochondria.

So when the way this works at the cellular level is that or medic stress, any type of stress taxes the mitochondria to some extent. Okay. And when the mitochondria are taxed they produce lots of free radicals, reactive oxygen species.

If they're being overwhelmed by that stress, they're producing a toxic amount of free radicals that actually so much free radicals that it ends up causing damage in the cell.

And the damage being present, all that oxidative stress and oxidative damage that's occurring then triggers that cell into defense mode. Right. Okay. But let's imagine that cell was under the same exact amount of stress.

But it had twice as many mitochondria to handle that same workload. Now all of those mitochondria, it's like having ten more guys to move the boulders right.

They can now handle all of that workload with much greater ease. While each individual mitochondria is being taxed much less heavily than in the prior scenario.

And by virtue of that, each one of them is now below their threshold of being overwhelmed. And so they don't end up producing this toxic, overwhelming amount of free radicals and oxidative stress.

They don't end up causing all this oxidative damage in the cell. And then the cell doesn't get triggered into defense mode. It stays in energy mode and time metabolism, where it's pumping out energy instead of shifting into defense mode.

So the way I think about it is more that the more mitochondria you have, the bigger and robust your mitochondrial networks are and stronger they are, the less sensitive your body is, the less easily perturbed it is by the stressors of life, the more it can handle the stressors of life with ease without being thrown off.

So you can get some exposure to, environmental toxicants without being super fatigued from it or, you know, having brain fog or something like that. That's makes a lot of sense.

And I can tell you just from my personal experience, you know, I used to be fairly fit and active when I was younger. And like most people, you kind of give up and feel you're invincible and you stop training.

And by my mid 30s, I was sick. Can you name a thing? I had it, and then I started training again and I kind of feel

like I can't get sick anymore. You know, even the common cold, my throat kind of tingles.

And by the time I try to figure out what to do about. It's already gone. Yeah, I feel that sense of resilience. You know, where, you can hit me with whatever it is, and I just.

Yeah, I'm exposed, so I'll get it. But the measure of health is that I can fight it fast. Yes, absolutely. So, and I certainly feel that it's kind of like even when I go to the gym.

No, you know, before I had to need the energy to get to the gym. Now I start and the energy is there like I, it's, I can feel like that first. Yeah. The first set might be difficult, but it just everything starts pumping and flowing, right.

And it speaks to that kind of training you're talking about where the mitochondrial load is increase and it's. Yeah, it's all put in perspective. It makes sense now. Yeah.

And this is why you can look at Arnold Schwarzenegger was in his 70s, still training and ripped because he never stopped. He just kept putting that stress on his body.

And he's able to do what the guys, even the young guys around him, can't. So that's. It's awesome to hear. So in terms of specific supplementation, I don't know if there's very specific things that you found have work.

I, I know going to some of the biohacking events and functional medicine conferences, you see a lot of people now more than ever before, touting mitochondrial support.

Right. But mitochondrial support could mean different things. It can mean relieving oxidation, like, you know, the ability what's happening of the cell.

It could be development of mitochondria, the biogenesis you're talking about. So what should you be actually striving for. What products do that I don't know if you have a sense of what what people should be doing there.

Yeah, definitely. So there's many different mechanisms of things that you can support at the mitochondrial level. There's compounds that you can take that act to help mitochondria grow bigger and stronger or to stimulate mitochondrial biogenesis.

These fall into the category of xeno or medics for the most part. So this is a type of hermetic stress that acts on many of these were medic stress stress pathways, but through something called Xeno or MREs, you know, with, an X in the scientific literature, if you were interested in looking it up.

And it has a lot to do with plant phytochemicals. So various kinds of anthocyanins and flavonoids and things like that can act on some of these same hermetic pathways to stimulate mitochondrial growth and biogenesis.

Things like curcumin, things like sulforaphane, resveratrol. There are still being, gyno stem, ginseng, Rhodiola rosea, many and many, many others, have compounds in them that act as xeno or medic stressors and stimulate mitochondrial growth and biogenesis.

PCU is another one that is very, very important for this. Another great thing to to support in this regard is, one aspect is just mitochondrial cofactors.

So, things like CoQ10, acetyl l-carnitine, alpha lipoic acid, ideally are alpha lipoic acid, and B vitamins are all hugely important. Co-Factors magnesium.

Very, very important. Co-Factors for mitochondria energy production. So that that's more straightforward. That's one layer that I think most historically, most mitochondrial supplements have focused only on that layer, where they conceptualize mitochondrial support as a matter of providing cofactors for energy production.

It's an important layer, but definitely not the only layer. So stimulating hermetic stress through the ZnO ha means

you're you're providing co-factors.

Another layer is stimuli aiding my autophagy and my autophagy is basically like autophagy, but at the mitochondrial level. So autophagy is basically the process of breaking down, dysfunctional, worn out broken cell parts and rebuilding new healthy cell parts.

So we do the same thing with our mitochondria, and we need to have a quality control process with our mitochondria, such that the defective ones don't get the chance to keep on living.

And, potentially divide and create more mitochondria, that are from that dysfunctional stock. Right. So we need to have this quality control process where we are breaking down and recycling the damaged, broken mitochondria, the ones that are, producing too much free radicals and oxidative stress and getting and not producing energy efficiently.

We need to get rid of those guys and rebuild new, healthy ones. And my autophagy is critically important for that. So there are there are not many things that have been proven to support my autophagy, but one of the the most critical ones is.

Something called euro. Listen, a and euro listen A comes from it's actually a metabolite that bacteria in our gut produce after digesting something called ellagic acid or Elijah tannins.

And this is a compound that is found in some foods. The richest foods in it are pomegranates and chestnuts. So pomegranates have this compound called ellagic acid.

When it hits our certain species of gut bacteria, they they break it down, they just digest it and produce a compound called euro. Listen a and euro list and a then goes into our bloodstream, where it is pretty much the most powerful promoter of my autophagy that has ever been discovered.

So you you so doing that is another layer of how you do quality control on your mitochondria. Supporting autophagy and mitosis, through adequate fasting windows every night is also incredibly important.

And one of the other aspects that I'll mention is, melatonin. Melatonin is the mitochondrial targeted antioxidant, and it is pretty much the most important, antioxidant for protecting our mitochondria, way more important than people realize.

Most people know of melatonin only in the sort of the sleep story. You know, melatonin is produced by our pineal gland, and it's a it's a hormone involved in sleep.

Many people don't even know it's a hormone. They think it's a just like a supplement. But, it's it's a hormone produced in our brain that's involved in sleep.

It turns out it's actually much more than that. It's a vitally important compound for protecting your mitochondria. And your mitochondria need to be bathed in melatonin in order to function properly and maintain the balance of, of of what's called redox balance, the balance of of oxidants relative to antioxidants.

Melatonin is vital to that process. Here's a layer to the story that most people don't know. Most of the melatonin produced in our body over 90% isn't produced in our pineal gland.

It's produced in our cells by the mitochondria.

Supplements and Mitochondrial Support

And one of the primary things that that allows your mitochondria to produce adequate amounts of adequate amount of melatonin is light exposure to near infrared light, in particular, which is something I've written a book about the ultimate guide to read in your infrared light therapy, near infrared light, which we get from sun exposure.

Or you can get from reading your infrared light therapy lights. Is interacts directly at the cellular level and helps the mitochondria basically recharge levels of melatonin.

So that's another critical layer to this, this story. Sleep and circadian rhythm. Absolutely. Another critical layer to mitochondrial health. And then as far as I kind of deviated a little bit from supplements here.

But melatonin is kind of crosses over a little bit. The last thing I'll mention is membranes support. There are certain compounds that you can take that protect mitochondrial membranes, which are very susceptible to the damage from oxidative stress.

It protects them from that damage. One such compound is called Astiz Anthon and Astiz. Anthon is, a carotenoid that comes originally from algae. And then it's concentrated in many other animals up the food chain.

It's what gives shrimp and salmon their pink color. But we can supplement with Astiz Anthon as well. It's also, you can take it in the form of salmon ro.

It's very concentrated in, salmon eggs. So that Astiz Anthon has a very unique chemical structure that, allows it to be embedded in mitochondrial membranes across the membrane.

So most antioxidants either act inside or outside of the cell. Vitamin C is water soluble. It acts outside of the cell. You know, other things are fat soluble.

Vitamin E, for example, acts primarily inside the cell. Asks is hemp, and has this unique chemical structure that allows it to embed across the membrane and stabilize the membrane and protect it from damage.

So Astiz Anthon is really a wonderful compound, and there's been several studies that have shown that it protects mitochondrial membranes from damage.

And then the last compound I'll mention is something called anti factor phospholipid supplements. There's an amazing paper by a researcher named Garth Nicholson who, wrote a paper called Lipid Replacement Therapy that, compiles the literature on a whole bunch of studies using this phospholipid supplement called NK factor.

And basically it's forms of phospholipids. These are the same lipids that make up our membranes, our cell membranes, mitochondrial membranes, and things like phosphate, choline, phosphate, butyl ethanol, amine, etc.

and this supplement has been used in several studies in people with various kinds of chronic fatigue. You know, it's one thing to have theory of like, oh, you know, oh, yeah, this works.

And so and so pathway and therefore it should result in this benefit. It's another thing to actually have hard evidence like here's this supplement in people with chronic fatigue.

What were their results in terms of their energy levels. And we know that in these studies there's been I think at least ten where they've looked at people with chronic fatigue syndrome, chronic fatigue from aging, chronic fatigue, associated with obesity, many other types of chronic fatigue.

And they have them take just this supplement. No other interventions just take anti factors. And within three weeks, four weeks, eight weeks, we see dramatic improvements in energy levels, 30, 40% increases in energy levels just from doing this one thing alone in a month or two.

So, and the reason why is that these phospholipids actually get absorbed into our, bloodstream intact and then end up making it all the way into the cell, believe it or not, and into the mitochondria, where they can replaced, damaged phospholipids and rebuild healthy membranes so that mitochondria can function better.

That's that's fascinating. And, you know, I want to end there measuring, okay, energy levels up 30, 40%. But there's all the other ancillary or side byproduct benefits that they don't even realize.

The disease prevention, the resilience, all that thinking that's happening. But so, first of all, this is like this hour went by, it felt like five minutes because it is.

Everything you're talking about is so incredible and so informative. I'm sure people are going to love what they what they heard. One last thing I would ask you.

So for the people that are obviously going to be intrigued to understand their mitochondria better after hearing this, there's one thing to say, yeah, that sounds like me.

I resonate with like low energy, etc.. Are there actual empirical tests that you can do to measure, like where are you at? Not really, not really not not very good ones.

There's a midas swab test where you can kind of swab the inside of your mouth. That's that might be the best one. There's been a couple things that have been done in the in the actual scientific literature to try to assess mitochondrial function like they've looked at it, in the context of people with chronic fatigue syndrome, measuring mitochondrial capacity in one way or another.

Sometimes they measure it in a petri dish, which is not a great way of doing it. Sometimes they measure other, other aspects of mitochondrial function.

There's, one that's been developed by researchers in the UK called an ATP profile test that's been pretty well validated, in, in patients with chronic fatigue syndrome.

But all of them are imperfect and all of them are. They're more built on the model of like trying to determine abnormalities in levels of co-factors. So like.

A lot of them, you know, might detect, oh, you know, the people with chronic fatigue syndrome have lower levels of CoQ10 or, you know, this cofactor or that cofactor.

It's not it's not really what we're like in the model that I'm presenting here, the cell danger response model. It's more a matter of mitochondrial shut down in response to stressors, and less a matter of just deficiencies of cofactors or something like that. Or.

I'm sorry. Yeah. So, you know, all those tests are imperfect. But they can give you some indirect insight. I don't want to, to bash them so much. Things test that I do like our heart rate variability testing.

And I love the bolt score, which is a very simple test that you can do for free at home. Body oxygen level test. It's a way of just doing a very gentle breath hold, and then stopping with your first urge to breathe.

If if you want. I could guide people through it right now, but, I don't know if we have time. And then the length of time that you hold that I, I find correlates very strongly to one's level of fatigue or energy.

And, and as one improves their, their bolt score, it tends to very predictably relate to improvements in energy levels. Sure. Yeah. Before we go, let's do it.

Let's do the bolt score right now. Cool. Do you want to bring up if you can just do a screen share, bring up like, just do a Google search for online timer and then we'll time it.

So what we're going to do and I'll just describe as you're bringing this up, I'll describe what we're going to do. You're going to do a few normal breaths in and out through the nose.

Calm, normal breathing, not deep breathing, not heavy breathing, just normal breathing. And then after a few breaths, you're just going to exhale out through the nose a normal exhale.

So instead of you know, doing a full force exhale you know, just a normal relaxed exhale stop at the end of the

exhale. So you shouldn't have all your air forced out in other words.

So a normal exhale if, if this is the full exhale that much. You know where a normal exhale kind of stops maybe 60% of the way there, 70% of the way there to a full exhale.

Once you do that, you're just going to pinch your nose and hold your breath, and you're going to stop when you feel the first urge to breathe, the first distinct urge to breathe.

You don't. This is not a maximal breath. Hold. Tests a time test, meaning you don't want to go, go, go and push, push until you can absolutely hold no longer such that at the end of it, you're going, you know, and you're gasping for air, that that's more of a maximal breath hold time test.

This is a bolt score, a body oxygen level test. And it's done in a much more relaxed way. Normal. Exhale. Pinch the nose. Hold until the first urge to breathe.

And then that first urge to breathe should be relatively relaxed. If you're gasping for air, that means you did it too long. Okay, so we're going to do three normal breaths after the exhale.

Testing Energy and the BOLT Score

On the third breath we're going to pinch the nose. So here we go. It's one. One more. And pinch the nose and hold and go. So we're obviously living different lives here.

Because I was done in 17 seconds. So ideally. So basically any anything below 20 is is is considered a sign of breathing dysfunction or a low score. Okay. Okay.

So ideally we want to be above 20. And then interestingly this test was done many many years ago. And it was sort of quantified among young, athletes.

I don't know if they were professional athletes, but maybe college athletes. And they looked at average bolt score times among, you know, sort of young, fit people.

And, they found that 30 and above was considered optimal. So, that's what we want to shoot for. And what we find in a lot of, a lot of people who are unwell is bolt scores of less than 10s.

So, so this is something that we can improve dramatically by bolstering our mitochondria and particularly through breath practices, which is just a wonderful form of hermetic stress.

In my opinion, the single fastest and most powerful way to increase energy levels in people with chronic fatigue that I've ever found in 25 years of studying natural health.

These breath hold practices are just amazing in their capacity to, create adaptations at the lungs. And as for as far as oxygen utilization at the mitochondrial level that, allow us to produce energy much more efficiently and, what you'll notice is literally within a few weeks, you'll start to see that bolt score going up by a couple seconds every week and maybe five seconds, you know, in some cases.

And, within a month or two, I've seen people just make massive improvements in their in their energy levels. Just by doing these breath hold practices or intermittent hypoxic training.

I've created a new program called breathing for energy with a guy named Patrick McCowan, who's the author of The Oxygen Advantage. One of the most world renowned, experts in breathing, practices.

And so he and I kind of partnered together to produce this program specifically for energy enhancement. And it's got a lot of his foundational practices and then a whole system of six levels of six progressive levels of, intermittent hypoxic training, breath holding practices that take you all the way from 10 to 15.

Second breath holds to, three minutes and beyond. So it's it's an amazing system. We're getting just phenomenal feedback from people about how well this works.

So if people I mean, obviously I think minds are going to be blown after listening to today, but for those that do want to work with you, potentially, is that the best way?

Yeah. The breathing for energy program is great. Is I mean, it's amazing actually the I have an Energy Blueprint program as well that's more, much more comprehensive.

Like all things nutrition and lifestyle. From gut health to hermetic stress to light to nutrition, like very, very comprehensive. And then, and then I have, a supplement line as well.

So like a lot of the compounds that I mentioned for mitochondrial health, are in our mitochondrial formula, I have a brain formula as well. And, very comprehensive, really premium, you know, top of the line multivitamin multi mineral and superfoods formula as well.

So where do people find all that. Yeah that's at the Energy blueprint.com okay. And they can also find your programs there. Yes okay I might end up rolling in one of those too because I gotta get my bolts score.

So yeah you do. Yeah. So Hari this was truly awesome. Fascinating. Thank you for sharing so much. I'm sure you're gonna help a lot of people. Again. Thank you for coming today.

Yeah, my pleasure. Thanks so much for having me.