## Introduction and Ari Whittenu2019s background

– Hi and welcome to another episode of Reverse Inflammaging Summit Body and Mind Longevity Medicine. And I'm very happy to be in this episode to have Ari Whitten, best selling author and founder of the Energy Blueprint.

Ari it's a pleasure to have you here. – Thanks so much for having me. It's a pleasure to be here. – Great, great. Let's get started by telling us a little bit about your story and how you got into the area of health. – Well, very short version is that health science has been my passion since I was a little kid and it started with just being uh an athlete. I was a martial artist and a soccer player growing up. And so as a result of that, and then growing into my teenage years, I became very enamored with body building.

So from, you know, the from the age of really 12, I was into training into studying exercise physiology and biomechanics. My older brother was a body builder and personal trainer.

So by the time I was 13, I was already very much in that world, studying nutrition, studying fitness and exercise physiology and I had some, some natural gifts for it. I was not a very good student in high school. I was not driven, I didn't have parents that drove me to study hard and all that sort of thing.

But on national standardized testing across the United States, I was still 98th, 99th%ile in science and I, and I was not 98th or 99th%ile in any other subject in math or English or anything like that.

There was a, a natural gift with science. When I was a teenager, I was also extremely interested in marine biology and live coral reef aquariums. And so I was doing all kinds of natural um experiments with natural ecosystems as in, from the time I was a teenager while I was also experimenting with the human body.

And so my background in health science was very much bio hacking. Before the term bio hacking existed. Bodybuilders were the original bio hackers uh since the 19 sixties, seventies, um using all, you know, huge amounts of all kinds of crazy and dangerous chemicals to uh enhance their physiology. Um decades before again, that this term bio hacking even existed and that education uh that type of education is, is very different because it's experiential.

It's not just conceptual, it's not just going to a classroom and learning about concepts of physiology or anatomy or biochemistry. It's actually understanding how your hum your own human body responds to different kinds of stimuli through experimentation.

And I would go so far as to argue that that kind of education is actually vastly superior to uh classroom education and for, for many, many different reasons.

But of course, it's better if you also combine it with classroom education, – I will support you on that. Because I totally agree that how we actually do the best in terms of knowing where we are is experientially not intellectually.

So I totally agree with what you're saying. – Yes. Yeah. And so that was my world for many, many years, you know, the world of, of fitness and athletics and performance enhancement. I went on to do a degree in, in exercise science and with a big focus on nutrition and, and exercise physiology and, um, and biomechanics and all that kind of stuff.

And I was a personal trainer for many years. I trained athletes, I as a performance enhancement specialist and then as a corrective en a corrective exercise enhancement or corrective exercise specialist.

I was a nutritionist for many, many years and then I did a master's degree in human nutrition and functional medicine. I did a, PhD program in Clinical psychology and then decided I didn't really want to be a psychologist. So

I don't have the PhD even though I completed three years, all the, all of the three years, of course, work for the, that PhD and then in my mid twenties, I got mononucleosis from Eps and BAR virus. And then I was left sort of chronically fatigued for about a year following that.

I'll spare you all the details. But basically, this was a catalyst for me as this guy who was always very fit, always an athlete, always had abundant energy. All of a sudden I lost my energy and I realized how important energy was.

And as I started to see doctors uh for my own chronic fatigue and I started to read online about it, I realized basically no one really understood the science of fatigue very well. And my own extensive background for 15 years already of studying health science and being very scientifically literate allowed me to see that, you know, within conventional medicine and within alternative and holistic and natural functional medicine.

I could see that no one really understood what controls and regulates human energy very well. Why people are chronically fatigued? How do we get our energy back within conventional medicine?

They don't have much of an explanation at all. They give people antidepressants and stimulants, C BT uh cognitive behavioral therapy. They, they really don't have much to offer.

And then within the natural medical community, the big focus was on adrenal fatigue. And when I started to look into the science underlying that I realized there really wasn't any science underlying it. And, and that there was no real scientific basis for this catchall term of adrenal fatigue that, that all the the natural health practitioners were saying is the explanation for why people are experiencing this, this chronic fatigue.

And that was the big catalyst for me to go. Well, it's clear that nobody's really understands the science of energy very well.

## Health span, longevity, and hormetic stress

Maybe I should, you know, switch my focus to that and start, you know, becoming obsessed with figuring out the science of, of human energy levels and, and that's what I've been doing for the last decade – And nothing like uh personal motivation to get things going. So you were doing this partly to address your own uh fatigue that you were experiencing, correct? – Initially.

Yeah. – OK. Yeah. Let's take a step back for a moment before we go uh more deeply into this. Ari what is your perspective on how we age in longevity? – It's a very broad question.

Can you be more specific? I wanna make sure I answer it in the way that you'd like me to. – Well, you know, we've, you know, this is a question that we like to ask all of our guests because there are a lot of different perspectives on it. You know, we have the seven hallmarks of aging. We have a number of different uh processes that take place in the body that contribute to it.

And I wanted to get your perspective on what you think is most, most important in that process. – Ok, perfect. So I think the concept of health span is incredibly important to understand.

So we have lifespan, how many years we're alive and health span is how many years we have a functional brain and body. And without so much illness and symptoms that are debilitating and, and um taking away our quality of life and our functionality and what we ultimately want to do is not only maximize our lifespan, but we want to maximize our health span. And we want those two lines.

We want, we want to push out that health span as close as possible to the lifespan so that we achieve what's called compression of morbidity as, as you guys, I'm sure are very familiar with that term.

And compression of morbidity means we want whatever debilitating symptoms or things that happen as far as the deterioration of our body and brain, we want to postpone that to the latest date, possible.

That's as close to our death as possible so that we have, you know, at the very end of our lifespan or as close to it as possible. That's when, you know, we really experience the deterioration of our brain and body.

But we, we push that out as far as possible. We extend our health span and we compress the period of morbidity to the last little bit of our lifespan as possible now.

So that's my general thoughts around longevity. I think that the concept of health span, compression and morbidity are are of critical importance. Now, having said that I think one area that's a big focus of mine that I think is greatly that I, I think is enormously important.

And um one of the biggest factors in achieving not only a long lifespan but especially a long health span. And that is, in my opinion, almost universally underappreciated or not even known by most conventional and natural and functional medicine practitioners. And that is the concept of hor metic stress, the the central role of hor metic stress in building physiological resilience at the cellular level, at the mitochondrial level as being of, of really of central importance to achieving a long lifespan and health span.

And I'll leave it there and we can certainly go into the details of, of why I say that. – Yeah. Well I appreciate you bringing that up because I certainly agree tremendously with that in my own work.

I'm always focused on people accepting the challenge, the challenges of life because that's what helps you grow from a resilience perspective. But I'd like you to define the term that you just used and, explain how you see it. Yes, I agree with you.

– The term physiological resilience stress, stress. OK. So hermetic stress is uh you can think of it as good stress. Stress that ultimately has a net beneficial effect on the body. So this is a transient stressor or transient metabolic stressor on the body. It's something that is stressful to your cells to your brain. That typically creates a spike in reactive oxygen species or oxidants. Things that we, most people typically associate as these bad molecules.

People think oxidants are bad antioxidants are good. We can talk more about that story because there's a lot more complexities to it than most people realize. But these are transient stressors typically that induce a spike of oxidative stress of oxidant.

But that stimulate adaptations in our body that stimulate our body to make adaptations that ultimately make our body more resistant to that stressor and actually to a broad range of other stressors. And that tho those adaptations that increase resistance to stress that increase physiological resilience ultimately are what are largely responsible for reductions in rates of disease, extensions of health span, extensions of of life span and longevity.

As well as having a big impact on our brain function and our energy levels and our mood and our quality of life at the same time? – That's great. Can you give us a few examples of what would be challenges that people in this audience watching right now could easily engage in? – Yeah.

So hor metic stress includes the most common example is of course exercise. Now, exercise actually is a catch all term for multiple different types of hor metic stress that really have their own unique adaptations that they're stimulating endurance exercise, uh high intensity interval training and resistance exercise, all all stimulate unique adaptations.

But all are hormetic stress, hormetic stressor. Fasting is a type of hor stress. We have thermal stress, heat stress and cold stress. So I think saunas and cold baths, which are both becoming popular in recent years.

And we also have other types of stressors, for example, breath holding practices, what's called intermittent hypoxic training as well as uh phyto nutrients, phytochemicals in plant foods. Small doses of slightly toxic molecules in plant foods, things like sulfurophane and Herin.

That actually as a result of being very slightly toxic as as a result. In other words, of creating a challenge or a stress to the body actually stimulate beneficial adaptations.

This is a concept called xeno hormesis uh where, where as a result of humans co evolving with many of these molecules over millions of years, humans not only learned how to detoxify these uh slight plant toxins, but we learned how to benefit from them at the same time. And there are other types of, of hor metic stressor as well that are, that are more obscure.

And we can also see psychological and emotional challenges as a form of hor metic stress that also uh invoke adaptations at the level of the brain, some a phenomenon called neuro hormesis.

And this can, I, I think there's a, there's a popular sort of idea of psychological and emotional stress right now, that is very, very common, very pervasive idea that I personally don't really agree with.

I think there's a conception, a widespread conception of stress as bad, you know, stress is, is harmful to us. We need to avoid stress because stress is bad for us. Of course, there's an element of truth in that chronic unavoidable psychological stress generally is harmful.

But challenges of stress, transient challenges of the psychological or emotional levels are are quite beneficial for us. And none of us grow into our fullest capacity without psychological and emotional challenges.

And I use the word challenges because most people have a negative association with the word stress, we replace it with challenges. All of a sudden people can wrap their head around the idea that it's beneficial.

And just as there is such a thing as post traumatic stress disorder, there is also such a thing as post traumatic growth. We grow through difficulty and through challenges, literally at the physical level, through challenges like exercise or breath, holding or heat or cold or fasting.

And we grow through psychological and emotional challenges as well at the level of the brain. So that's a very quick overview of kind of the concept of hormesis.

And I'm happy to dig into some of the specifics of how it works at the cellular level if you'd like to go there or some other place. – Yeah. Sure. But I like everything that you have to say and with regard to stress being good or bad or that there's good stress.

What I find most important as to whether it is helpful, supportive or not is a person's mindset in which they engage with the stress. If they engage with that stress from a okay, I'm going to, I'm going to engage and figure this out, they have one result.

As Hans Seier said, it becomes you stress. But if instead they cringe from it and go oh my goodness, that can become distress. So mindset plays an important role in that. I was curious with your temperature, heat and cold, how much heat, how much cold duration, intensity makes a difference or has an impact.

– Do you mind if I comment on what you're saying about mindset for a second before we go there? – Sure sure It's it, I'm glad you brought that up because it's actually quite complex when you consider that component to it because we not only have this sort of objective, purely physiological reactions to a particular stress and what those physiological effects are, but the stress is also being mediated by our mind and our, psychological responses to it and our belief systems about that stress.

## Mindset, heat and cold exposure, and practical dosing

So there was a just as one point of contact here, there was a study done at Stanford's Mind body lab by a researcher named Ali Crum. And what they did was they took a group of people, they divided them into two groups and they wanted to study the, the, the impact of exactly this, of what somebody's psychology is around, how they perceive stress. And how that impacts the stress response when actually exposed to stress. So what they did is they took one group and they had them watch a three minute video on all of the negative effects of stress.

So how stress suppresses your immune function and causes a surge of these bad hormones like cortisol that do

these bad things that degenerate your brain and and disturbs your sleep and causes chronic inflammation and you know, disturbs your mood and lowers your energy levels and all these sorts of things that, are negative effects associated with stress.

And then they subjected them to a battery of stressful testing. I forget exactly what they did. But basically they, they did a process in the lab that was basically putting people through a stress.

And then they took the other group and they put him through the same battery of tests of, of stress. But prior to that, they had him watch a three minute video on all the positive effects of stress and how stress creates a surge of hormones that increase alertness and reaction time and energy levels and um enhance your resilience.

And when you're under, when you're, you know affected by stressors and a number of other benefits, and then they examined the differences in physiology when those people were actually exposed to the stress. And what they found is that the people who watched the negative video were much more likely to experience all those negative symptoms. And the people who watched the positive video were much more likely to not experience those negative symptoms and to experience mostly positive effects, increased energy and so on.

So what we, what we can see is exactly what you were just saying that that one's belief systems about stress are absolutely causing placebo and nocebo effects in terms of how they are reacting to the stressors they're exposed to in life.

– And I think that research and those findings are fantastic because they put more of the power of our lives in our own hands. You know, if we could find the right belief system, it will help us in our, in our health. So I think that's great.

Thanks. That was very informative. Yes. Back to the temperature. If you can kind of give us a little some parameters to those facts. – So specifics as far as like practical use of cold and heat. – Right. Yes.

– So there's lots of nuances here to get into, I'll try and do this succinctly. But if somebody is very heat intolerant, they don't want to go into a sauna at 210 degrees and sit there for half an hour if, and in general also, the more that somebody is ill, the more that somebody is in poor health, the more that somebody is unfit is largely sedentary, the more that it will be a very bad idea to jump into a sauna at a very high temperature or jump into a cold bath at a very low temperature.

Because basically the the the the sicker you are, the less healthy you are, the less fit you are. The lower your resilience is going to be, the lower your tolerance is going to be to extreme doses of either cold or heat. So the dose and the intensity has to be massively ti traded for the individual and where they're at.

And this can, this can be the difference between starting your sauna journey at 100 and 10 degrees for three minutes versus 210 degrees for 35 40 minutes, right? So that's, that's a difference of the individual's capacity. So it's that big of a difference.

I mean, we're talking double the temperature um and more than double the duration and the same is true of something like exercise as an example just to, to illustrate the point I think it's a little easier to understand here.

Um, if you've been weight training for two decades, maybe you want to go under the bench press and try to bench press £300. If you've never been in a gym before, it's a really bad idea to try to lift a barbell.

That's £300 you know. And the exact same principle is true when it comes to, heat and to cold. You have to start with baby steps at a, at a very low dose, a very non extreme intensity of that temperature.

With cold baths, you know, you start, you can start with gentle cold showers is a great way of doing it just for, you know, even 10 seconds, 30 seconds.

You don't want to jump into an ice bath yesterday, I went out to my, cold plunge and found a giant ice cube floating

in there. And the biggest one I've ever seen actually, and it was close to freezing temperatures and I was a little intimidated to get in there anyway, like that.

It's a bad idea for somebody who has no experience with cold plunges to then go in that temperature. Even for me where I've been training it for a long time, that was an intense experience.

So yeah, it has to be adjusted accordingly. But start, start where you're at, start slow and start small, whatever feels the best guide is your own discomfort.

So, doing a, a shower at 60° or 65° for 30 seconds, feels difficult and really uncomfortable for you. That's where you start. And we also have to realize again that there's a psychological component to this part of the adaptation is, is not purely physiological. It's actually our minds becoming tougher.

We're training mental toughness to be able to tolerate physical discomfort. And so there is a physical process of adaptation and a mental toughness training that also has to take place. And this is also literally related to the pain processing in the brain, the no susceptive centers of the brain.

Because this process of systematic exposure to discomfort also increases your pain threshold. And in other words, decreases your brain's sensitivity to pain, painful and disco uncomfortable stimuli.

– Yeah, it's so amazing. Our brain and body's ability to adapt and, and what you're talking about is that the more you challenge your brain and body, the, the even greater the ability to adapt and increase the, the sort of the boundaries of what's OK for an individual.

– That's exactly right. And if you maybe as a natural segue to that, do you mind if I maybe explain some layers to what's going on physiologically? Ok. So what you just said relates to a concept that I call the, the resilience threshold. And basically, it's a term that I created to express one's level of physiological resilience. And what this is largely a function of is one's mitochondrial health and mitochondrial. Then the robustness, the health of one's mitochondrial network. Now as a as a sort of some some data points to get at what I mean, we have a number of lines of evidence that have shown that on average with each decade of life. After the time, one is roughly 20 years old, people's mitochondrial capacity, the the energy production capacity of their cells throughout their, their body. And most of the energy comes from mitochondria.

From for virtually all of the trillions of the of cells of our body, from our brain, to our heart, to our liver, to our intestines, to our muscles, to our bones, to our skin.

Pretty much the, the vast majority of that energy is coming from mitochondria. They are the energy generators of our cells. So on average, that capacity to produce energy declines by about 10% with age might not seem 10% with each decade. State of life might not seem like that much.

## Mitochondrial resilience, aging, and oxidative stress

But what this means is they've shown that in the, in the typical 70 year old, they have lost 75% of their mitochondrial capacity. OK. And specifically what has been shown is uh a loss of 50% of the actual number of mitochondria and for the mitochondria that are still present in those cells. So let's say you go from 2000 per cell to 1000 per cell. And now for those 1000 that are still present, they have only 50% of the energy production capacity that those mitochondria had when you were 20 years old.

Now, the natural response to this might be. Well, jeez, that really sucks that aging causes this, this massive loss of mitochondria. But in fact, this is actually not a natural process of aging.

And we know this because when we look at 70 year olds who are lifelong exercisers, they do not lose 75% of their mitochondrial capacity, they have the same mitochondrial capacity as young adults do.

So what this is not a natural process of aging but is a product of modern lifestyles. And what's going on here is the

best way to visualize it is if you've ever broken a bone and you got a cast on your arm or leg. And then eight weeks later, you went back to the doctor, they saw off that cast and you look down at your leg and it's half the size of the other one. It's half the size as it was eight weeks prior.

And the reason why is because the body only cares about survival. The body cares about what it and and it will only maintain whatever is needed to survive. The environment that it's in and the way that it gets information on what's needed is if those systems are being challenged.

Right. So, if that muscle is immobilized in a cast in literally the span of just two months, your body goes, oh, I guess we don't need all that energetically costly muscle anymore.

Let's get rid of it. Well, the exact same process of atrophy happens internally in our cells at the mitochondria level as well. And if you do not challenge your mitochondria regularly, they atrophy, they shrink, they shrivel away and they die off. And that is fundamentally why most people are losing 75% of their mitochondrial capacity as they get older.

And uh it is atrophy as a result of disuse as a result of lack of challenge, lack of stimulation, lack of hor metic stress. That is the thing that challenges our mitochondria is exposure to hormetic stressors.

And if you lose that, you, you're basically think of it like this. You're going from a Ferrari engine in your cells when you're 20 to a moped engine in your cells, when you're 75 or 70 and you cannot be physiologically resilient and handle stress and handle the ubiquitous stressors that are a part of modern life. You can't handle that and demands on your system. If you have a moped engine in your cells instead of a Ferrari engine, this is a huge factor and we don't fix this just through taking B vitamins and coq 10 and alpha lipoic acid and acetylcarnitine and de ribose and, and thing and PQQ and whatever else. That doesn't rebuild the engine. So you can eat a healthy diet.

You can avoid stress, you can meditate, you can sleep well. You can take lots of supplements and all of those things are wonderful and helpful, but you also have to do the hard work and the, the, the uncomfortable stuff of hor metic stress in order to actually rebuild the engine into a more youthful cellular engine. And that's the basis of physiological resilience. – That's so let me, if I get you correctly, that it's possible to rebuild. If you get it back into exercising, that you can restore some of that mitochondria.

– Yes. So the good news is our bodies are an intelligent dynamic adaptive system that is constantly trying to adapt to, to the environmental stimuli. So if there's just as if there's a lack of stimulation, the body says, hey, let's get rid of these energetically costly tissues that, that aren't needed for the survival and the environment we're in, they're actually, they've just become a liability to, to keep them around. If they're not being used and challenged.

On the other hand, if they are being challenged, and if you are systematically training in a way where you're pushing the limit of your body's current capacity, you're stimulating your body to make adaptations that make it grow stronger.

And um what we're doing at the cellular level is we are creating the stimulus for mitochondrial biogenesis. We're creating the stimulus for literally growing more mitochondria, growing a bigger cellular engine and, and growing bigger and stronger mitochondria. In addition to creating more mitochondria from scratch, at the same time, there's another component to what's going on there that greatly relates to this concept of inflammaging.

That's in the title of this summit, of course, which is we have an internal system that is very much related to this whole process I've described and it's called the ARE, the antioxidant response element.

And this is our internal endogenous antioxidant and detoxification system. And it's composed of many different um many different compounds like glu toone and superoxide dismutase and catalase and hem oxygenase. These, these very powerful internal antioxidants and detoxification mechanisms and what we, what we now know and what I was alluding to at the beginning of this podcast with, you know, kind of this alluding to this oversimplification of oxidants as being bad guys and antioxidants as being good guys.

Is there is a complexity that's built into the system for a number of reasons. Number one is the quote unquote bad guys of oxidants. Actually, it turns out are to some extent good guys, at least in the appropriate dose and context because they actually serve an important signaling role uh that mediates a lot of the adaptations that I just described with. Hormetic stress.

So the spike in oxidants and reactive oxygen species is actually what is signaling to the mitochondria that they need to grow bigger and stronger and, and signaling mitochondria, the need for mitochondrial biogenesis.

So, um maybe as a quick digression many years ago, it was thought that you know, we, we had all this body of research for many decades on the benefits of exercise and reductions in various diseases. And we knew exercise was very healthy.

But researchers thought um well, the we know exercise is very beneficial. But the problem with exercise is that it creates this big spike of free radicals of oxy of oxidants.

So what we can do is we can do the exercise, get all the benefits of the exercise, but just take antioxidant supplements like vitamin C and, and vitamin E, vitamin A, an acetyl cystine, things like that.

Either before or right after the exercise or during the exercise to allow us to get the benefits of the exercise, but suppress these, these bad oxidants.

And what they found in these studies was that when they did this, they actually canceled out most or even in some studies, all of the benefits, the metabolic benefits of the exercise.

And so what this research allowed us to understand is that many of the beneficial effects of exercise in enhancing longevity and health span, reducing disease and so on.

Improving mitochondrial function are are dependent on the spike in free radicals. And if we suppress that with antioxidants, we actually are canceling out many of the beneficial adaptations we get from exercise.

So, what what this means is that this simplistic kind of paradigm that people have formed, um and most practitioners have formed around oxidants being bad and antioxidants being good. And we need to neutralize the oxidants by taking lots of vitamin C, vitamin E, vitamin A N ac Gluta, all these sorts of things.

Actually, it turns out many of those compounds down regulate the internal antioxidant defense system. So what we can see is that those the exogenous use of too much antioxidants makes our body produce less of its own internal supply of antioxidants.

And paradoxically, the things that create a big spike of oxidants or medic stressors build up the internal antioxidant system. I think most of the research at this point is pointing to because we know we have a lot of research showing that antioxidant supplements do not extend lifespan and do not prevent most diseases like was originally theorized for many decades. Harmon's three free radical of of aging that that model has really been debunked. At this point.

We have tons and tons of research showing that taking lots of uh exogenous antioxidants doesn't really prevent disease and prevent aging and extend lifespan like we thought it would. But paradoxically, the things that create spikes in free in oxidants do seem to reliably prevent disease and extend lifespan and health span. Hormetic stressors.

So what what this means if you pair this up with the fact that these oxidants are serving important signaling roles. It means and that we have an internal antioxidant defense system. It means that the body is trying to regulate redox. It's trying to regulate the balance of oxidants and antioxidants at the appropriate levels to get the the the needed signaling effects, but to avoid too much excessive oxidative damage that damages the cells drives inflammation and accelerated aging and disease.

So, what we want to do from this paradigm is ideally work with our body to allow it to regulate that balance in the

appropriate way and the way we build robustness into that system is through regular exposure to hermetic stress.

– That was brilliant. That was brilliant. One last question on mitochondria. I like to tell people that I work with that the body has two choices. It could be in defend and protect or it could be in grow and heal.

And so that's one of the reasons why you don't want to always be in stress because you want to take your body out of protect and go into heal and grow.

And I know you've spoken about two functions of the mitochondria, energy production and self protection. So I'm wondering if there's a relationship here, if you can say, explain that to us. – Yes, absolutely.

So this is actually something that I normally explain much earlier in the conversation. But I, I like the way this conversation has unfolded. This is largely thanks to the work of uh a brilliant researcher named Doctor Robert Naviaux, who runs a lab for mitochondrial medicine at the University of California San Diego.

And he published a paper many years ago called the cell danger response. And this was a sort of a synthesis of many years, decades of research into what mitochondria are doing by researchers all over the world.

And basically, we found out that, you know, kind of the way we're taught about mitochondria in high school and college and, and graduate level physiology courses as just sort of these mindless energy generators that are taking in carbs and fats and pumping out energy in the form of ATP is really way oversimplified and that mitochondria are much more complex and much more important than we ever realized and, and perform many more roles than we realize.

Dr. Naviaux calls them the central hub of the wheel of metabolism and metabolism. Is the most people associate this word with kind of like weight and resting metabolic rate.

But the word metabolism means the totality of all of the biochemical reactions occurring in your entire body. It's everything. And he's saying mitochondria are the central hub of the wheel of that meaning mitochondria are really, really important in human physiology.

And there are two fundamental roles of mitochondria, not just, not just one, not just as energy generators.

## Mitochondria in energy vs defense mode and closing remarks

They are that, but in addition to that, they are also environmental sensors and they are exquisitely sensitive environmental sensors. They're like the canaries in the coal mine of our body whose job is to constantly sense what's going on in the environment, sense, what's going on in the body and determine if the body is under attack essentially. So they're constantly taking samples and really asking the question, is it safe for us to produce energy?

And this gets into exactly the way you described it, which is to the extent that they're picking up on signals that say it's the environment is safe. They operate in energy mode, they, they put their focus on producing abundant energy to the extent, however, that they are detecting danger signals, threats present that o are overwhelming the their capacity, their resilience threshold to handle that stress, they shift their function out of energy production and then they coordinate a cellular and metabolic response to put them into defense mode instead of energy production mode.

And of course, a good example for people to feel this to connect with this uh concept is just think of the last time you had a cold or a flu or COVID or that you really overdid it mentally or physically or got a really horrible night of sleep or something like that.

What's one of the main symptoms of getting a respiratory infection, fatigue you're tired, you wanna lay on the couch and rest, you don't feel lots of energy to go do stuff. This, this is the mitochondria shifting out of their role in, in energy production and shifting more towards cellular defense.

And it's important to understand these are these dual roles of the mitochondria are mutually exclusive. So two are there two sides of the same coin? So to the extent they're doing one, they are not doing the other to the extent that they are being tasked with defending against threats. They are not operating in energy production.

And you can think of this like if you're in your kitchen, chopping vegetables, preparing dinner and somebody walks in and puts a gun to your head and says, give me all your money and all your jewelry.

You don't just carry on chopping vegetables and prepping dinner. You have to handle that threat that's present. And so that's what's going on with mitochondria at the cellular level to the extent they're tasked with defending against threats.

They are not operating in energy production mode. And it's of course not a black or white thing. It's a, more of a dimmer switch. – Yeah. Yeah. So more reasons to why, while there's some good stress that it's important to have a, a life of balance between stress nonstress.

– Yes. Now, let me connect this piece to what I described with all the previous stuff and the resilience threshold, how robust your mitochondria, your mitochondrial network is your cellular engine is whether you have more of a Ferrari engine in your cells or a moped engine in your cells will actually largely determine whether your mitochondria are operating in energy mode or defense mode. Because if you have let that cellular engine deteriorate and shrivel in atrophy, you have lowered your resilience threshold dramatically such that lower and lower doses and intensities of stressors, whether it's environmental toxins, whether it's psychological and emotional stress, relationship, stress, whether it's sleep deprivation or any other source of stress, you are lowering your physiological resistance resilience to that stress at such that lower and lower doses and intensities of stressors will push you over the edge will, will be sensed by your mitochondria as a threat to the system.

And Ok this is a threat that's, that's too big. We can't handle this. Let's turn down the engines for energy production, shift resources towards cellular defense.

So hopefully, you can see now how these two concepts tie in the concepts of Dr. Navioux cell danger response, mitochondria are either in energy mode or defense mode.

And that is now tying in to hermetic stress and what, what is the status of your cellular engine, Ferrari engine or moped engine that is going to largely determine how your body copes with and is able to respond to the the stressors of life.

Are you gonna be overwhelmed by them and have fatigue and all kinds of symptoms and brain fog and disease and accelerated aging or is your body robust and resilient such that it can cope with those stressors maintain the appropriate redox balance?

So you don't have chronic oxidative damage and inflammation, driving aging and disease and maintaining health and homeostasis and high energy levels. So that all of that ties into the robustness of your cellular engine. – Right. And gives us a a really good picture about resilience on all levels. So I really appreciate that this has been a wonderful conversation. Ari I really loved everything you had to say and the time has flown.

So I was going to ask you about your light therapy. I have a best selling book out on that, but that will be a conversation for another another episode. So thank you so much for being on our summit and really, really appreciate all the important insights you've given to us.

Thank you. – Yeah. Thank you so much for having me. It was a pleasure. I've really enjoyed it. – Thanks.