Jason Prall: Ari Whitten, thanks for joining me on the Immune Resiliency Summit.

Ari Whitten: Yeah. Thanks so much for having me, Jason, always a pleasure.

Jason Prall: Well, I like to bring you on as my light guy. We talk a lot about circadian rhythm about how light affects biology, and to me, honestly, from the scientific world, we are just scratching the surface. And look, this goes back probably a century or more, people studying light as it relates to biology, and yet we're still uncovering so much. And I know, because we were talking offline, you've got some new material that I haven't even heard of, likely. So I'm excited because you like to dig into the science, the new stuff, and really expand your thinking.

And what I really love about you, honestly, not to butter you up too much here, but I love the fact that you're always trying to poke holes in your own understanding or theory. You're always trying to find where your thinking is off, which is why you and I love to, almost, debate and discuss, try to pick each other's stuff apart, because that's so important to me because it strengthens my position and also shows me where I might have some gaps in my thinking, where I'm not so smart as I think I am, where I'm not so lock-tight with my thinking. So I'm excited to see what you got.

Ari Whitten: Yeah. Thank you so much for saying that. I definitely appreciate the same thing about you and I'm really into the spirit of the dialectic these days, as far as, yes, poking holes in my own ideas, poking holes and others' ideas, and that's something I've always done naturally, but what I really enjoy is relationships with really smart people where we're engaged in that sort of interaction, but it's not in a negative or malicious spirit to prove the other person wrong. It's to both evolve and both arrive at some greater truth and help each other explore and find the truth together. And that's just something I appreciate more and more and really value those kinds of relationships that I have with certain people, like you, that you can even do that with.

Jason Prall: Yeah. No, I agree. And I'm glad you made that distinction, I find that there's an evolution in the ability to have a conversation where it maybe goes from more of a debate or an attack to, "Oh, I checked out something new, what do you think." Or this is what I think, and then you are challenging that. And it's almost like an engaging, enjoyable childlike discovery of these concepts.

Ari Whitten: Yes.

Jason Prall: And in a way, I think if we do it in the right way, it really ignites my imagination and gets me excited about maybe a new insight that I think I might have, and I go look for evidence to see if that's even plausible. In these types of things where it's this engaging, uplifting conversation.

Ari Whitten: Yeah. And God knows that the world needs much more of that.

Jason Prall: Agree.

Ari Whitten: With how polarized and divided everybody is right now on so many different things.

Jason Prall: Yeah.

Ari Whitten: So I think it's something that we should all try to learn it and try to model as much as possible, not just in health science, but in politics too.

Jason Prall: Absolutely. Well, and this Immune Resiliency Summit is kind of in that spirit, where there's a lot of, let's just say, unsettled science about what the immune system is, what a germ is, how this all works, and the level of complexity that I think is involved. And so, again, this is why I like bringing you on, because you're going to provide another level of complexity, but also interesting aspect that I think empowers us from a health perspective. So what do you got for us on the light front today?

Ari Whitten: Yeah, well, I have a bunch of really cool novel stuff. And to your point about things being speculative and us still learning, yeah, absolutely. I think that's true. I think this whole COVID thing has really exposed how much we don't know about the immune system. We have all this weird stuff of the fact that antibodies are disappearing after a short period of time, and the idea that you can fight off the infection without having antibodies, and that it's possible to have some segment of the population that has immunity to it without having antibodies, and that you can have these non-antibody dependent immune mechanisms, mucosal immunity, T-cell immunity, and then all the issues around the antibody tests that some people don't make antibodies that some people who make antibodies, the antibodies disappear.

And there's all these layers of weirdness, and it seems to me, to be honest, cause I've read a lot of the works of virologists and infectious disease epidemiologists, it seems to me that they are genuinely learning a lot right now. And this is not all panning out exactly as they predicted. It's like, we're all learning right now. And so in that spirit, I think I have some cool stuff to contribute, as far as novel understandings of key roles of light, in particular, and how our immune system works. So with that said, let's jump into it.

We are going to be talking about light and immune system health. So first of all, I want to make the point that mal-illumination is very much the equivalent of

malnutrition. And we need to understand that, just as if we don't get enough vitamins and minerals and phytochemicals and adequate protein and carbs and fat and fiber and all these different things that we need from our diet, we arrive at malnutrition. We also can have that exact same result in the form of mal-illumination. We can have that same result when it comes to light, because there is a spectrum of light. There are different bioactive wavelengths of light, and the human body requires adequate amounts of certain of these wavelengths in order to function properly. Just as, again, we require protein, carbs, fat, fiber, vitamins, minerals to function properly, we need all of those things in adequate amounts. And just as it's possible to have toxicity of certain of those things, that too much of them can lead to problems, the same is true of light.

So this is a nice quote from one of the pioneers of talking about light science in regard to human health, Jonathan Ott, and he was writing books back in like the fifties and sixties, and he said, "Mankind adapted to the full range of the solar spectrum and artificial distortions of that spectrum, mal-illumination, a condition analogous to malnutrition, may have biological effects." Well, this was back in the fifties or sixties that he was writing it and saying it may have, being in an office under fluorescent lighting, may have biological effects. Well, now we know that it does, and it has very serious effects.

Light plays a role in our circadian rhythm, our sleep and wake cycles, mitochondrial function, immune function, inflammation, hormonal regulation, neurotransmitters, and much, much more than that. This is really just scratching the surface. Now, we're exposed to lots of light each day, whether it's from natural light sources or artificial light sources. And it's important to understand these things have very different light spectrums. And depending on whether you're a Hunter gatherer living outdoors for several hours a day, hunting or gathering or going to the stream or, whatever, playing outside, or you're indoors in an office under fluorescent lighting staring at a computer screen all day, you have to understand you are getting radically different kinds of light nutrition in the same way that eating blueberries and sweet potatoes and greens is different from eating hyper-processed cakes and cookies and crackers. That's the same thing that we have going on with light exposure

Jason Prall: And real quick, Ari, to that point, I see a nice movement happening in the technology space where we're trying to mimic sunlight spectrum a little bit better, and I think that's great. And also there's another aspect too, which is the density, or the flux. The amount of light. And so I would imagine that there's a big difference between sunlight and indoor light in that regard too, right?

Ari Whitten: Absolutely. Yeah. So it's orders of magnitude difference in terms of light intensity being in an indoor environment versus outdoor environment. And in particular, that has a huge... I was going to reduce it down to circadian rhythm, but the truth is that that intensity of light also affects us numerous other ways. So what are these different biological wave lengths? And let me start off by saying, a lot of people don't even realize that light is bioactive in humans. We

don't grow up with this knowledge. We grow up with the knowledge that like light is the opposite of darkness, if you want to see things, you flip on a light switch, that's what light does it allows you to see. And then when it's dark, you can't see. And that's really our extent of our perception of the role of light in our lives.

And then for some people, they maybe have some awareness of UV light, sunlight, and vitamin D. And maybe if they really have a bit more awareness, they know that all those rays of ultraviolet light from the sun interact with our skin and are used to synthesize vitamin D and vitamin D is involved in the skeletal system, they have some idea that it's involved in immune health, and maybe even there's growing awareness now of, for example, blue light, and how that interacts with the circadian rhythm through a different pathway. And that's through the eye pathway that blue, and to some extent, green light, feeds in through the eyes to neurons to the circadian clock in your brains, this part of the brain called the suprachiasmatic nucleus, and that in turn, regulates all kinds of things from our sleep and wake cycle, to our energy levels, to our mood and cognitive function, neuro-transmitters hormones. All kinds of things are tied to the circadian clock.

But beyond that, there are still other types of wavelengths that we get from natural light sources, like the sun, that are bioactive through completely different mechanisms. We have far infrared, which is basically like heat and has various mechanisms. It increases nitric oxide production and blood vessel dilation and sweating, potentially. So like infrared saunas revolve around far infrared energy. And then we have red light and near infrared light. And just that alone, there's over 5,000 studies on that subject, and I've written a book on that called The Ultimate Guide to Red Light Therapy, and those act again, through totally different mechanisms. They actually penetrate through our skin inches deep into our body, where they interact at the cellular level with our mitochondria and they do all kinds of things. They stimulate mitochondrial energy production, they have what are called hormetic effects, they decrease inflammation, they also stimulate the production of various tissue regeneration and tissue growth compounds. So for example, nerve growth factor, brain-derived neurotrophic factor, muscle growth factors like IGF-1, skin growth factors cause stimulation of collagen synthesis and so on.

So my point of all this is to say, light is not just the absence of darkness. There's a whole bunch of different nutrients or wavelengths of light, and they are bioactive in us through many, many different mechanisms by interacting with neurotransmitters in our brain, vitamin D, different hormones, something called cholesterol sulfate, something called the melanocortin system. They interact with inflammation and with immune system function in many, many different ways, which is really the subject of this presentation, and mitochondrial function.

So there are system-wide changes in response to light exposure, and especially sunlight exposure in particular. So we need the right doses of these light

wavelengths, and also timing is a factor as well. And what I can tell you, there's a lot of complexities around that, but the short answer is, most people are wildly out of farming with the doses and the timing of these light nutrients that their body actually needs for optimal function. And this has very profound consequences when it comes to immune health and many other aspects.

Jason Prall: And real quick, I want to jump in there, if you go back to that last slide real quick, it's interesting that you have all these things neurotransmitters, which essentially regulate mood amongst other things, we have hormones in there, inflammation. Those directly, we have an experiential relationship with. You and I both live in the San Diego area and we take advantage of this all the time, we go down to the beach and we lay out. And simply just laying on a beach, of course you've got the waves and the sounds there, but just being out in the sun, we all have this experiential wisdom that it relaxes me. It puts me to sleep. It makes me feel good. It recharges me. Without knowing any of the biology, I can immediately say the sun is doing good things to me, right?

Ari Whitten: Yeah. And in fact, to that point, it's actually been shown that endorphins are released, which are like endogenous opiate-like chemicals, from the skin, in response to ultraviolet light exposure. And those endogenous opiates, those endorphins, feed back into the brain and create a pleasure response. So what that means, again, to your point, is that evolutionarily speaking, we are actually wired to seek out and find pleasure from exposing our bodies to the sun. Now, why would that be? Is it a mistake that we're wired this way by millions of years of evolution or by creation, if you believe in that? Probably not. It's probably an intelligent design that helps us intuitively seek out something that's very, very good for us and very important for our health.

Jason Prall: It makes sense.

Ari Whitten: Yeah. So let's talk about UV light. There's many, many layers to the UV light story. I'm going to go through this briefly because we could spend three hours just talking about UV light and all the mechanisms behind this alone, but there's some really cool stuff here that most people are unaware of. So a few quick points I want to make here, one, vitamin D is very important. Yes, it is. And that's what most people associate with UV light, and we're going to talk in depth about vitamin D.

Number two, and this is really important, is a pill cannot replace sun sunlight. So we do not want to reduce down sunlight, or even just UV light, even isolated UV light, we don't want to reduce that down to, "Oh, that's what UV light does. That's what sunlight does. It helps our health by creating more vitamin D." Okay, that's one of many different mechanisms of how sunlight impacts our health. So the important thing to understand there is, you can't exist separately from the sun and then just pop a vitamin D pill every day, and then assume that you're getting all the same benefits that you get from the sun. Nope, you're not.

Jason Prall: And real quick, sorry. I want to jump in there cause Dr. Stephanie Seneff and I have had this conversation about sulfate and sulfur, and she's does a lot of research into the sulfur and how it works in the body. And that's one of the things that she talks about is, when we get sunlight, it's actually the sulfated cholesterol that gets converted. And so she doesn't make any conclusions, but she's curious as to, perhaps, part of the mechanism that that is so important there, is the sulfur aspect of that, and when you take a vitamin D3 pill of some sort, you're not necessarily getting that sulfated aspect.

Ari Whitten: Yeah, absolutely. Yeah. And she was critical in building out the knowledge around cholesterol sulfate, which is something we're going to talk about.

Jason Prall: I love it.

Ari Whitten: So, yeah, I agree with that. The other thing I want to mention is, there's a lot of fear of sunlight, and UV light in particular, as far as skin cancer. This could be a long conversation, I have a whole chapter dedicated to this topic in my upcoming book on light, and it's absolutely fascinating to explore. The very quick and short answer to this is, getting sunburnt is not good for your skin. Getting sun exposure below the threshold of sunburn, is not linked with increased risk of skin cancer, of melanoma in particular, which is the deadly form of skin cancer. And in fact, what is linked with increased risk of melanoma, is what they call intermittent sun exposure, which is basically someone who is sort of indoors all the time and then every couple of weeks or something like that, they go out and have a long day in the sun and get way too much sun exposure beyond their skin's capacity to deal with that and they get sunburnt and that's their sun exposure.

Jason Prall: Sounds like most of our culture, really.

Ari Whitten: Right, yeah. Or they're in London and then they go on a vacation to Hawaii and they lay out all day for a week. That kind of sun exposure is not healthy, in the same way that someone who's sedentary all the time, wouldn't benefit from once a month going and running a marathon. All they do is cause damage to their body by overwhelming, by doing an amount of exercise, doing a dose, that is way beyond their body's capacity to tolerate that kind of exercise. So the same is true with sun exposure.

The best test here is to understand that, the best kind of study, is to understand that outdoor workers, they've actually compared them to indoor workers in terms of risk of melanoma. This is a very straightforward experiment, because if more sun exposure leads to more skin cancer, the people who get 5 or 10 times more sun exposure, outdoor workers, should have a lot more melanoma. They don't. They actually have lower risk of melanoma. And again, that's because they don't have intermittent sun exposure, they have frequent daily sun exposure that's below the threshold of sun burning because their skin actually has an opportunity to adapt.

The other aspect that's critical here, I won't go into in depth, is your diet has a major impact on how resilient your skin is to sun exposure. And if you have a crappy diet, your skin will have very low resilience to sun exposure and will burn easily, and that diet, nutrition, and sun interaction will increase your susceptibility to sunburns and skin cancer.

Jason Prall: If you could boil it down, if there's one aspect of a diet or food or something that I was consuming that is not cohesive with a lot of sun, what would it be?

Ari Whitten: Lack of phytochemicals.

Jason Prall: Okay. So more plants.

Ari Whitten: So dramatically increasing your consumption of phytochemicals, berries and leafy greens and things of that nature. So just to give you an idea, there's studies just looking at individual phytochemicals, like just cacao consumption, or just lycopene from tomato paste, there's literally studies where they ask people to eat 40 grams of tomato paste for eight weeks and they measure their skin's resilience to UV rays, and just that one thing of just tomato paste, 40 grams of tomato paste per day, leads to, like, an 80% increase in the skin's resistance to ultraviolet radiation.

And again, that's just one phytochemical. So when you start to fill your diet with a lot of these different kinds of phytochemicals, you can have dramatic effects. Astaxanthin is another huge one that has really amazing research showing how it acts as an internal sunscreen. And having a good diet that's rich in those kinds of phytochemicals, is really critical to allowing you to actually be out in the sun and have your skin be resilient to it so it doesn't get burned, so that you can get all of these amazing benefits of sun exposure that I'm about to tell you about. But yeah, just wanted people to understand don't fear the sun and understand what kind of sun exposure actually puts you at risk, and understand the connection with diet, and understand that vitamin D pills do not replace sunlight.

Jason Prall: And just as a quick comment, it's interesting to note that when we go near the equator, we see a lot of these, what might be called, super foods in our modern context, even though I don't really like that word, but it's pointing to the fact there's tons of color. There're tons of those foods. And we find them right there at the equator where the sun's the strongest. So it's interesting how nature seems to have a way of providing and balancing with the environment.

Ari Whitten: Right. Yeah. And if you look at some of those super foods that you're talking about, for example, really darkly-pigmented berries, they actually gain their color in response, largely, through rays of the sun. Same way that our skin darkens up in response to the sun, so does the skin of the fruit. So interesting stuff going on there for sure and very nice observation.

Okay. So just as far as UV light, again, which is part of the sun spectrum, there's so many mechanisms beyond just vitamin D. One is nitric oxide, one is regulation of the melanocortin system, something that's really important, very few people know much about, and production of something called hem oxygenase, again, not very talked about, but very important, cholesterol sulfate, which we talked about before a bit, modulation of the microbiome, reduction of fat cell inflammation, turns out blue light doesn't just interact with the circadian rhythm, blue light can actually penetrate our skin and interact with our subcutaneous fat cells in a way that has profound metabolic effects and of course, vitamin D. So I'm going to take you briefly through just a few of these mechanisms, just to give you an idea of the fact that sunlight interacts with health more broadly, but even in particular, immune health, just through... Ultraviolet rays have all of these different mechanisms. This isn't even to include circadian rhythm or red and near infrared light or any of that, this is just ultraviolet light.

So UV light is a very, very powerful weapon against metabolic dysfunction. And let's look at nitric oxide first. So, when we think of nitric oxide, we usually think of it in terms of two things. One is synthesized within our bodies from the amino acid arginine, and the other thing is consumed from foods like leafy green vegetables and beets and things of that nature. So when we get nitrates there it increases nitric oxide levels in our body, but there's actually a very important third way we get it, which is sunlight exposure. And sunlight powerfully and dramatically boosts levels of nitric oxide and this nitric oxide has been shown to have all kinds of beneficial roles in the body. It's actually very complex, I will admit that it's to the point of complexity where I don't understand all of the interactions, and I think that's in large part due to the fact that no one understands all of the interactions because there's widespread interactions between nitric oxide in many different systems of the body and we're still, I think, in the infancy of our knowledge there. But we know that UV light in increases nitric oxide levels, we know, for example, this has a profound effect on regulating blood pressure levels. And that-

Jason Prall: And I just want to highlight too that it says UVA, right? We're so familiar with UVB and vitamin D, to your previous point, I just wanted to sort of highlight that there. It's interesting.

Ari Whitten: Yeah. So UVB is involved in vitamin D synthesis and also cholesterol sulfate. UVA also has its own mechanisms, right? And so I'm kind of lumping ultraviolet altogether as one just for the sake of simplifying. So I don't delve into too many nuances of all this stuff. But yes, very good observation. So many, many studies looking at its effects on all kinds of aspects of metabolic health and blood pressure. But we also know that it has an impact on mitochondrial health and we also know that it has an impact on immune system function. So, this is a paper called Nitric Oxide and the Immune Response, and they said that nitric oxide has been recognized as one of the most versatile players in the immune system. And they said a large number of immune system cells produce and respond to nitric oxide and it has an important role as a toxic defense molecule

against infectious organisms. So, critical role there. And I just want to mention, again, some of these mechanisms just to make the point that sunlight has profound effects on us beyond just the vitamin D story.

So, one of the other ones that's little known as the melanocortin system and this primarily has an impact on regulating our hunger levels and our body fat levels. So again, which most people are unaware of, right? That sunlight exposure to our skin regulates our body fat levels. And there's a whole bunch of research showing that, and then mechanistically this seems to be one of the key reasons why is through this melanocortin system. But in addition, we also know that the melanocortin system regulates inflammation and has a profound effect on immune system health as well. And we know, by the way, just to give you a brief rundown, part of how this melanocortin system works, it's tied to melanin in the skin. So in response to sun exposure, our brain secretes something called alpha MSH and that's melanocyte-stimulating-hormone and that's involved in the actual process of developing tan in response to sun exposure.

But this alpha MSH does all kinds of other things in the body too. So, for example, it suppresses Interleukin six, it suppresses inflammatory cytokines. And just to connect some dots here, this Interleukin six, inflammatory cytokines is linked with higher risk of severe symptoms in COVID. So very interesting point there. So melanocortin system, then there's another mechanism from UV called heme oxygenase and we know from different animal experiments that animals that are deficient in heme oxygenase have excessive oxidative stress and have disrupted blood vessel and endothelial function. Now, why is this important? Well, there's more and more research suggesting that COVID is linked with endothelial damage and endothelial dysfunction. So the more that you get that kind of damage, the more you get risk of thrombosis, the more you get potentially damage to the lungs, and as a result difficulty breathing and oxygenating your blood and your tissues. So this heme oxygenase seems to have a role in preventing endothelial damage and optimizing blood vessel health.

Really interesting little side point, but heme oxygenase after it's synthesized in response to sun exposure actually breaks down into two interesting compounds. One is bilirubin and one is carbon monoxide, believe it or not. Carbon monoxide, like carbon monoxide poisoning, like you'd get from sucking on car exhaust? Well, carbon monoxide is actually produced in our body, and believe it or not, it's linked with a whole bunch of benefits in the proper dose. So, this carbon monoxide-

Jason Prall: Let me just say that Ari is not recommending that you go do this from an outside source. This is an internal process, just wanted to put that out there.

Ari Whitten: Yes, this is a recommendation to get sun exposure, not lock yourself in a garage with a running car. So, let your body produce it. Don't try to suck it in. But your body produces it in very small amounts at the cellular level in response to sun exposure from this heme oxygenase and this regulates inflammation. Keep in mind again, just to connect the dots, part of what leads to very severe COVID

symptoms and death is an excessive inflammatory response, a cytokine response from the body. So, I'm just tying these subtle pieces of the puzzle together in terms of how your body regulates inflammation. Bilirubin is another important factor here and also regulates oxidative stress and inflammation. So, there's also a rare condition called Gilbert's Syndrome, which is a genetic condition, and they have... It's kind of remarkable that you have this genetic disease, but it doesn't actually cause you to die sooner. If anything, it has the opposite effect. It actually causes you to have half the risk of dying from basically any cause so that you're much more likely to live to the maximal human lifespan because it elevates pre-bilirubin levels in the body. So, sun exposure can help do that as well. And by the way, spirulina kind of mimics some of that same effect as well. And spirulina, by the way, has some synergism with sunlight exposure. So all good things to sort of try and replicate that.

Jason Prall: But that's one of those things that I always try to do, is if I know I'm going to be outside a lot is get a ton of greens like a lot of chlorophyll. There seems to be something that we're able to actually use the chlorophyll almost like a plant would, so to speak, right? And I'm using that loosely, but there's something there with chlorophyll.

Ari Whitten: Yeah, actually quick funny story. When I was in high school, I had a biology teacher, she was like super, super hippy girl and this was back in the mid '90s. And at that time, being health conscious and drinking green juices wasn't that popular yet, but she was doing that. She was juicing, she was drinking green juices, she'd show up to biology class every day and she'd be drinking a green juice. And then she'd literally go out in the middle of the day and she'd go lay in the sun. And we used to make fun of her. And we used to like say, oh, this crazy hippie thinks she's a plant and thinks she can like do photosynthesis. And funny enough, just a couple of years ago, there was a paper that came out showing that in mammalian cells, and humans are mammals, in mammalian cells there is a particular metabolite of chlorophyll.

And I think it's something called PI something, I'm forgetting the exact name of the compound, but it's basically a compound that when we break down chlorophyll, we produce this metabolite of chlorophyll. And when it builds up in our cells, it actually interacts with light. It interacts with red and near infrared light in particular, and the way that it interacts with that red light is it's involved in the recycling of reduced CoQ10, which is a compound, it's an antioxidant, it's an electron carrier involved in mitochondrial energy production. So basically, the combination of light plus dietary chlorophyll can have an effect on ourselves producing energy. Now it's not photosynthesis, but it is a process of which light and greens and chlorophyll can actually, to your point, result in our cells producing more energy. So there is some magic there.

Jason Prall: Yeah, it's amazing.

Ari Whitten: So creation of cholesterol sulfate, we briefly chatted about this before, but the gist of this there's, Stephanie Seneff goes into all kinds of details of it. But most

relevant to COVID in particular is cholesterol sulfate builds up on red blood cells and creates more negative charge on them, such that like two magnets of the same pole, they repel each other. And instead of clumping together, they're spaced more apart, which is optimal. We want them to be spaced more apart, and that ultimately leads to more efficient oxygenation of the tissues, delivery of oxygen by the red blood cells. So, this also is a potential factor involved that is another way that sunlight can potentially help protect us from the severe manifestations of COVID.

Jason Prall: So cholesterol sulfate is a good thing, right?

Ari Whitten: Yes. And we synthesize that in response to, again, ultraviolet in particular ultraviolet B rays like with vitamin D. So, now having said there's all these non-vitamin D mechanisms of sunlight, so hopefully I've made that point that you should not think that just taking a vitamin D pill is a substitute for sun exposure. Let's talk about vitamin D, which also is really, really, really important. So first of all, just brief overview, we have UVB light penetrates the skin and then basically creates pre vitamin D. And that pre vitamin D goes into the liver and then into the kidney to get converted into active vitamin D that that sort of does its magic in the body. Now, I'm going to skip this.

Okay. Now, historically we thought about vitamin D as a player only in bone health. We knew about it in relationship to rickets, which is basically bone malformation. And if you don't know what it is, do a Google image search for rickets and you can see what that looks like when somebody grows up with rickets. But basically the bones become very weak and soft and you get total deformities of the skeletal system. But since that time, we've now discovered that vitamin D has a role in many, many, many other systems of body and especially immune health. So, what I want to talk about here in particular is infections. And I'll get to that in a minute, but what I want to mention before that is just vitamin D deficiency, the prevalence of this.

So, there's about 42% of Americans in general who are vitamin D deficient. This is nearly one in two people. And actually, if we look at darker skinned people, if we look at Hispanics, if we look at blacks, the blacks in particular are closer to 75% deficient in vitamin D. And the reason why is they have higher melanin content of their skin, melanin absorbs UV radiation so that less vitamin D is synthesized for every given unit of time that you're out in the sun being exposed to UVB. In other words, the darker your skin, the more sun exposure you need to get in order to synthesize adequate levels of vitamin D. So, the reason that people have white skin is so that if you're living in a place like Ireland, or someplace up there, Norway or something like that, you can make adequate amounts of vitamin D with very, very small amounts of sun exposure.

Now on the other hand, if you're from more equatorial regions or in Africa, you have so much intense sun exposure that your skin has developed basically a system for minimizing the potential risk of being burned, having skin damage, in response to that sun exposure by developing higher levels of melanin in the

skin. And so it's pros and cons, right? Depending on where you live, it's either a good thing, or it's created an evolutionary mismatch. If you're a Somali person living in Sweden in Stockholm, you have a really high risk of dying from COVID right now. And the deaths in Sweden are extremely disproportionately shifted towards non-white people, towards people with darker skin and elderly people, and they also have low vitamin D by the way. And Somalis in particular, there's a high number of Somalis who live in Sweden and they make up a huge disproportionate percentage of the people who are dying, again, because of this evolutionary mismatch. You're not supposed to have people with that skin color, living at that latitude, getting that little sun. So, vitamin D is a very, very likely reason why you see those sorts of disparities based on skin color. And we're seeing it all over the world. Not just in, for example, the United States. And there's, not to digress too much, but it's important to understand also that different wavelengths of light, parts of the full light spectrum, when in isolation do not behave necessarily the same way as they do when they're as part of a complete natural spectrum. So, that is especially true of isolated UV light. It has much higher risk when you have artificial UV light sources as opposed to sunlight, which has UV light in tandem with a whole spectrum of other light, many of which in particular, the red and near infrared part of the spectrum, combats the oxidative damage that can occur from isolated UV light.

Jason Prall: Right. The natural balance there.

Ari Whitten: It's sort of like saying blueberries are healthy therefore refined sugar is healthy.

Jason Prall: Right.

Ari Whitten: If you just isolate the sugar portion from the blueberry and take that by itself, it behaves differently than if it's in the context of the whole blueberry.

Jason Prall: Right. Yeah.

Ari Whitten: So.

Jason Prall: Great point. I'm glad you mentioned that.

Ari Whitten: So, let's talk about infection. There’re many different mechanisms of how vitamin D interacts with our immune system and infection. One of them is skin color itself. So this is a function of how much melanin you have in your skin. And it's important to understand that white people and black people, with the interesting exception of redheads, have-

Jason Prall: That's me all, that's me.

Ari Whitten: So this is actually an interesting example, Jason, I don't know if this is actually true of you. You might not be-

Jason Prall: I'm kind of quasi.

Ari Whitten: Yeah. You might not be full this skin type, but the true Fitzpatrick skin type, like from full on red heads from Ireland, they actually have an entirely different type of melanin in their skin. And so I'm, and I think this is true of you too, we are actually more, in terms of our skin and our type of melanin in our skin, we are more similar to a black person from Africa then to a red head from Ireland.

Jason Prall: Fascinating.

Ari Whitten: In terms of the type of melanin, because the difference is not in type, it's only an amount. So a black person from Africa just has more melanin, but the same kind of melanin, more melanin in their skin. Whereas a person from Ireland has an entirely different type of melanin in their skin and they have actually a very low tolerance to sun exposure and to UV exposure at the same time. But this melanin actually has antimicrobial properties. So the melanin itself, especially when stimulated regularly by sun exposure, can actually engulf and kill invading microbes at the skin level. It possesses antiviral activity. It can neutralize fungal and bacterial toxins, and it can activate the innate immune response, if needed. The sun also has direct antimicrobial effects, both blue light and UV light, on the skin surface.

Just as an example, if you're outdoors, like at the beach, there's almost zero risk of transmission of COVID or other respiratory infections in an outdoor environment, especially if it's sunny. Primarily for this reason, in addition to air dilution. UV light ... and this also explains a lot of the seasonal rhythm, right? Why is there a flu season? This is also true of coronaviruses and cold viruses. Why is there a flu season and a coronavirus season? Why do they follow seasonal patterns?

Well, outdoor UVA and temperature differences ... Or, I should not say UVA in particular, but ultraviolet light differences, as well as higher levels of vitamin D. Or I should say, during the season lower levels of vitamin D in us, predisposed to an environment where that virus can exist more stably and infect people. And have a higher infection rate and risk of developing serious infections. So, it follows the seasonal rhythms.

We have many different ways that melanin and melanocytes actually combat microbes, but UV radiation also leads to vitamin D, which plays two key roles in fighting infections. One is, low levels of vitamin D lead to poor immune system function and low levels of antimicrobial compounds being produced, that predispose us to getting infections and not fighting them off well enough. And low vitamin D levels predispose to dysregulated immune responses and too high of levels of inflammation and cytokine storms, which are linked with severe COVID outcomes, and death in particular.

Jason Prall: That's like the runaway inflammation that can't be mitigated, or pulled back, or controlled or balanced, right?

Ari Whitten: Exactly. So, having adequate levels of vitamin D in the system actually ... Not only does it stimulate the immune system response, but it also acts like a brake on the immune system response when the immune system response and inflammation are becoming too much, and you're having just this excessive, uncontrolled inflammation. Then vitamin D goes in, it turns into another compound, and basically starts to tone back the inflammatory response.

In COVID-19, again, we have this excessive inflammatory response, cytokine storms, and again that's inhibited by vitamin D. We also know that vitamin D levels are linked with COVID-19 mortality rates, and COVID-19 severity. So, there's already data on that. I'm going to show you some stats in a minute on that. But again, just to make the point, we know that vitamin D inhibits ... This is basically looking at-

Jason Prall: Calcitriol is vitamin D?

Ari Whitten: Yes, correct. Yes. This is basically looking at uncontrolled lung inflammation in response to ... They gave these animals bleomycin, which is a compound that causes lots of lung inflammation, and they looked at how vitamin D interacted with that. The vitamin D basically suppressed excessive inflammation. Same thing here. They showed that in the context of acute lung injury, which again seems to be happening in COVID-19, vitamin D played a role as an anti-inflammatory agent.

So, again: two things. It's stimulating the immune response, helping you to fight it off; and while also simultaneously helping you to prevent an exaggerated inflammatory response. There's a whole bunch of studies showing how it ties into both the innate and adaptive immune system. It's a regulator of both.

In particular, this is a cool study talking about, is vitamin D a new anti-infective agent? They talk about how vitamin D stimulates the production of something called cathelicidins, which are a family of peptides that are found in macrophages, immune cells, and leukocytes, that are involved in basically breaking down viral particles. So, they sort of wrap themselves around the viruses or bacteria, and they disrupt the membranes of them and help to fight against the infection.

We know that, as I say down here at the bottom, vitamin D3 exerts protective effects during infections by up-regulating the expression of cathelicidins and defensins, which are related compounds in immune cells.

So, again, another aspect of this is interferon gamma, which is another potent antimicrobial compound, which turns out requires adequate amounts of vitamin D in order to work properly. They found in this particular study that the

antimicrobial pathway in human macrophages, which are one of the immune cells that's part of the innate immune system that fights off invading pathogens, if it's cultured in vitamin D sufficient blood - but not from blood from African Americans that have lower amounts of vitamin D for the reason I described before - that interferon gamma didn't induce the antimicrobial pathway in the blood that was deficient in vitamin D. And then when they added the vitamin D to the serum, that restored the interferon gamma antimicrobial peptide expression.

Jason Prall: Wow. What I'm kind of hearing as you're outlaying all this, is that vitamin D acts ... We can think about it as this massive signaling molecule. In other words, it just does a lot of stuff. It's turning on a lot of different things, and it's acting in a lot of different pathways, it seems like.

Ari Whitten: Yeah. Yeah, 100%. There's many ... And this is really oversimplified, but vitamin D basically stimulates the innate immune system. It stimulates macrophages. It stimulates the production of these compounds that directly fight off pathogenic invaders, pathogenic microbes.

One of the other things I actually took out of this presentation, but it's worth mentioning, is we're aware at this point that children have almost zero risk from COVID-19, and that obviously it really goes after elderly people. Well, one of the things that's important to understand is the innate immune system is really strong in little kids, and vitamin D is a big part of stimulating the innate immune system. So, there are links here that are very important.

I'll also mention briefly, because I'm going to connect the dots here later, mitochondria are also critical to the function of the innate immune system, and children have healthy mitochondria. Adults, and especially elderly people, tend to have really damaged and dysfunctional mitochondria, and far less of them.

So, there's some research now suggesting that the robustness and health of the innate immune system, which again is oversimplifying, relies largely around healthy mitochondria and vitamin D, among some other things; and is really critical to keeping the pathogen at bay before the adaptive immune system and antibodies ever even kick in. So, I think for having a really strong innate immune system and strong mitochondria, adequate vitamin D is a really critical part of this story.

Jason Prall: Makes sense.

Ari Whitten: This is a meta-analysis of many different trials on vitamin D supplementation against respiratory infections. I'm using this data, but again, I'm not saying vitamin D supplementation is optimal. In fact, I'm saying it's really sub-optimal compared to natural sun exposure. But even just the vitamin D aspect through supplementation decreased the risk of respiratory infection by more than 50%,

especially in people with low baseline vitamin D levels. Which again, one in two people are. Or close to 75% are, if you're Black.

Now, in terms of COVID-19 severity and vitamin D level, these are ... There are several studies, now. This was one of the first that came out, and it showed massive associations between vitamin D levels and your risk of severe outcomes in COVID. So, here at the bottom you can see mild infections; ordinary or moderate; and then severe and critical infections. They break it down by what proportion of people were in each category.

What you can see here in mild, is that basically almost everybody who had a mild course of COVID-19 infection was sufficient in vitamin D. And then, on the other end of the spectrum, almost everybody who had a severe or a critical case of COVID-19, almost none of them were sufficient in vitamin D.

So, 86% of all cases of people who had ... Let me rephrase. 86% of cases of COVID, of people who had adequate vitamin D levels, were mild; while 73% of cases among people with vitamin D deficiency were severe or critical. So, these are massive, massive effect sizes. This is not just a slight sort of statistically significant correlation. These are massive effects.

Jason Prall: Yeah. I just want to point out here, too ... and you and I, Ari, love looking at optimal, right? This is one of those things with vitamin D that it's still debated in, let's say, the anti-aging, longevity, optimal health community as to what is optimal when it comes to vitamin D measurements. But I think we can both agree, right, that 30 nanograms is kind of a ... That's like a bare minimum when it comes to sufficiency, right?

Ari Whitten: Yes. Yeah, and thank you for making that point. Yeah. I mean, if we look at ... The best thing is to look at people in their natural environment. So, you can look at tribes who are still hunter-gatherers, living outdoors, our ancestral way or life. Or even, there are studies looking at athletes living in Montana and Idaho and measuring their vitamin D levels. These are people who spend quite a bit of time exercising outdoors. What those levels of getting around optimal look like, are actually about 10 nanograms per milliliter higher than this: closer to 40-45 is probably the optimal range. So, we're seeing even just being above 30-

Jason Prall: Yeah, it's still amazing.

Ari Whitten: It's strongly protective, but yeah. I think it's very likely, to your point, that if you start to get up near 40, that's probably going to be even more strongly protective.

Jason Prall: Yeah. This is honestly an amazing chart. Once you can kind of wrap your mind around what we're looking at here, this is not small. This is insanely critical. And again, imagine. I'm curious what it would look like if you started measuring

people that were 40 nanograms per milliliter or more. I'd bet you would see almost all of them have either no symptoms or very, very mild symptoms.

Ari Whitten: Yeah. Well, we're already seeing that at above 30. So, yeah. You might just eliminate these rare cases at that point. Yeah, yeah. But thank you for adding that. It's an important point.

Here, just to tie this in again to race and skin color. Keep in mind, if we're looking here, in the red and yellow are the deficiency range. Green and blue are fairly optimal. Green is the best, as we were just kind of discussing: above 40.

But what we're seeing here is the percent of adults who actually have vitamin D levels in this range. So, only 6% of Blacks have over 40 nanograms. 94% are sub-40, and about 80% are sub-29. So, you have a massive effect there, and in contrast to about 50% in whites.

Jason Prall: This is a result of our modern society, and the way that we've structured our lives, right? I'm just thinking through if I was Black or Indian, or I had really dark skin, I'm aware of this knowledge and yet still I would find it somewhat difficult. In other words, I've got to really put forth an effort to get outside and get naked, right, and expose much of my body to the sun. We just don't have that luxury, a lot of people, to be able to do this. So, this is a tough thing, right?

Ari Whitten: Right, and there's some very practical limitations, right? The fact that in certain latitudes, you have a chunk of the year that UVB isn't even present, at all.

Jason Prall: Oh, God. I was in Seattle. I grew up in Seattle, and it's like, yeah.

Ari Whitten: You also have the fact that during the time of day that UVB is present, which is closer to the middle of the day, a lot of people are working in indoor buildings. They can't just go out and lay in the sun for an hour, and that's really what darker skinned people would need to do to be sufficient. Like literally, middle of the day, lay horizontally with almost all your skin exposed for at least 30 minutes or so.

That's probably what you need to do, at least maybe every other day in order to be sufficient. To be honest, that's like I have ... I'm from more Mediterranean ancestry, and that's how much sun exposure I need. So, somebody with much darker skin than I have needs quite a bit more than that. [crosstalk].

Jason Prall: But I also want to ... Yeah, it's tough. But I think you and I would both agree that no matter what each individual circumstances are, just recognizing and understanding the reality here helps us make better decisions, right? So, if we can just move the needle, then it's a good day.

Ari Whitten: Yeah, and the other thing to understand here is, it's free. Right? The sun is free. This doesn't require spending a whole bunch of money to buy some fancy

technology. You can buy a UVB therapy light, if you can afford it, which can allow you to synthesize vitamin D for whatever time you have available. They're, like 500 bucks, and that's something that is worth getting, for sure. That's a smart investment.

But if you can't afford that, at the very least, if you're stuck indoors all day during the window of time where there's sun exposure, at least get it on Saturday and Sunday, every single weekend. Make that time to get it. It's just so vital for your health. Vitamin D can be stored in the system, so you can synthesize, potentially, enough on the weekends to sort of get you through each week. And again, at least it's free, if nothing else.

Jason Prall: Exactly, yeah.

Ari Whitten: So, again. Just emphasizing vitamin D: Really, really important for many different mechanisms when it comes to COVID outcomes. The other thing I want to mention here is the circadian rhythm. This is another pathway through which light affects us, and if you're unfamiliar with the circadian rhythm ... I assume most people are at this point, but basically this is a 24-hour clock in our brain that regulates our sleep and wake cycles. It regulates different neurotransmitters and hormones, and all kinds of aspects of our physiology: our energy levels, our mood, our wakefulness, and so on. And it's largely regulated by light exposure, and in particular blue and green wavelengths of light.

So, when you are outdoors and you see a blue sky, that blue sky is literally blue wavelengths of light entering your eyes. That is a daytime signal to your circadian clock, and your circadian clock regulates all kinds of hormones and neurotransmitters in response to that. The absence of that blue light entering your eyes - darkness, or just the absence of blue light - creates a cascade of different effects, and particularly involving melatonin, which is something that's a critical piece of this puzzle.

So, poor circadian rhythm has been linked to all kinds of negative health effects, from obesity and diabetes to heart disease to cancer. Many different types of cancers, many different types of psychiatric disorders and neurological diseases, gut diseases, and so on. There are thousands of studies now on disrupted circadian rhythm and many, many different diseases.

There are all kinds of mechanisms that have been mapped when it comes to both circadian rhythm and sleep disruption, and obviously circadian rhythm and sleep are both very much tied together. They're interfaced and sort of ... They're almost one and the same. You can't have great sleep unless you have a strong circadian rhythm, and vice versa. You can't have a strong circadian rhythm without adequate sleep. So, they kind of interface and feed back in multiple different ways, and also have their own unique effects.

But one of the big ones is immune system dysregulation, and there is a huge amount of research now linking disrupted circadian rhythm and sleep to disrupted immunity, for example, in shift workers. This one showed that shift workers show an increased risk for viral infections because of a possible compromise of the innate immune system and the adaptive immune system.

This one showed ... Together these findings indicate a specific role of sleep in the formation of immunological memory, so they found that after a vaccination against hepatitis A, sleep on that night was particularly important for creating a robust and lasting immune response. In addition, there are studies showing shift workers - which is pretty much the epitome of the extreme of disrupted circadian rhythm - have more infectious illness and acute respiratory infections than non-shift workers.

So, many different effects here. There's also now research looking specifically at SARS-CoV-2, which is the virus that causes COVID-19, and looking at how sleep interacts with that. They said there are clear reciprocal dependencies between sleep duration and quality and the immune responses against viral, bacterial, and parasitic pathogens.

Many, many different studies here, and I could go on and on. But I want to mention again now, as I alluded to before, mitochondria are a central hub of the immune system, and the innate immune system in particular. I really like this title of this study, because we've always learned in our high school and college biology classes that mitochondria are the powerhouses of the cell. This one says, they're the powerhouses of immunity. And over the last 10, 15 years, scientists have really built out a much broader understanding of mitochondria's role in human physiology. They're not just these mindless energy generators that take in carbs and fats and pump out energy. They're environmental sensors and they're regulating what's going on with what our cells are doing and what our metabolism is doing. And they went so far as to say here that mitochondria lie at the heart of immunity. So mitochondria are obviously a very big part of what I do with the energy blueprint and with energy levels in particular, but with immune system health in particular.

Now, I want to tie that fact of mitochondrial health in with circadian rhythm. And in particular, I want to talk about melatonin. Melatonin is this hormone that we all know about, and a lot of people just think of it as a supplement, but we all know it's tied to sleep. We know melatonin, that's a sleep hormone, really important in helping me sleep. But there's one big secret of melatonin that not a lot of people know about. Melatonin is probably the single most potent protector of your mitochondria in existence. And in particular, it is one of very, very few compounds that can actually get inside the cell, inside the mitochondria, where it acts as an antioxidant and protects the mitochondria from damage. Most antioxidants cannot get into the mitochondrial level.

Now, it also does some really amazing things once it's there. So this is a mitochondrion, and once melatonin gets into that mitochondria, it not only acts

as an antioxidant, but it protects mitochondrial membranes, and it interacts with our internal antioxidant defense system. In particular things like superoxide dismutase, catalase and glutathione, which is this really important internal antioxidant and detoxification compound.

Now let me actually just tie that fact into one thing. So this is another study showing that melatonin regulates glutathione redox status in the brain and liver mitochondria, correcting it when it is disrupted by oxidative stress. Now there's research coming out, showing that deficiency of glutathione, may be the most likely cause of serious manifestations of COVID-19. So glutathione deficiency, serious contributor to COVID-19. Now consider, and go back here, that melatonin, again, plays this critical role in regulating our cellular and mitochondrial levels of glutathione.

Now, here's something shocking that most people have not considered related to light. Typical standard indoor room lighting, just being in your house with the lighting in that room, suppresses melatonin by upwards of 50 to 70% in most people. 50 to 70% suppression of this critical compound that's vital for protecting your mitochondria and keeping adequate levels of glutathione, which not just protect your energy levels, but protect your immune system's ability to fight off infection. So you see this connection between light, mitochondria glutathione and the immune system.

Jason Prall: So what you're saying here, Ari, is that if I'm up late watching TV, I'm under artificial lighting, particularly at night, but really anytime, that is suppressing my natural ability, the circadian rhythm of my production of melatonin, which of course melatonin is, it has an impact on sleep, but also plays a role at the mitochondria level by basically turning on a lot of things. The internal antioxidant defense system, as well as helping to recycle glutathione so that it's usable.

And so, really what you're saying is, by staying up late and watching TV at night and having artificial lights on around me, I actually increase my susceptibility to experiencing severe reactions of any infection.

Ari Whitten: Exactly. Exactly right. You got it. In addition, it's also impairing your sleep at the same time. So people who use media devices before bed, which suppress melatonin, are 1.5-fold more likely to have worse sleep quality, 2.5-fold more likely to sleep less, and 2-7-fold more likely to be excessively tired during the daytime. So now by disrupting sleep quality and sleep duration, you're now amplifying the harmful effects on immune function in other ways. And over time, you're creating damage to your mitochondria, which are again, this hub of the immune system.

So, could show you a whole bunch more studies, but that's the gist of it. That's really important to understand about this connection between, again, light and mitochondria and glutathione and the immune system, your ability to fend off pathogens effectively. Now in terms of the primary causes of circadian rhythm

disruption, in my program I teach over 30 different strategies, but the gist of this is we're getting not nearly enough light and bright light. As you alluded to at the beginning of this, as we talked about, indoor light environments have way lower light intensity than outdoor environments.

So when we're indoors all day, we're not getting nearly enough of that daytime signal into our circadian clock. And then at night, we're still in indoor environments with all this artificial light and we're getting all this light when we shouldn't be getting it. And it's suppressing our melatonin levels, and all of the negative effects of that and disrupting our sleep and our mitochondria health and our glutathione and our immune system function.

So as far as two big things you could do here, bright light exposure, outdoor sun exposure, within the first half an hour of waking up. Ideally get as much outdoor, bright light as possible during the day. And keep your nighttime home environment relatively dim and use blue blockers or blue and green blockers and change your indoor lighting to be more like candlelight or use incandescent light bulbs. And those simple changes, I think I listed off maybe four or five there. Those simple changes will have a profound impact on your mitochondrial health, which not only will impact your immune system, but also have the side benefit of boosting your sleep, boosting your energy levels as well, and preventing numerous different diseases, like cancer in particular.

Jason Prall: And, Ari, what do you do in the morning? What's your morning routine as it relates to getting this light?

Ari Whitten: Yeah, I mean, first thing, right after waking up, I head straight outdoors. And I do a little morning movement routine for spinal health and just getting my body moving a little bit. And at the same time I'm doing breathing practices and I'm getting sun exposure in my eyes. And then after that I do my bathroom business. And then usually I take my dog to the beach and we do an hour or 75-minute, 90-minute time at the beach, running around and getting lots and lots of sun exposure. Hopefully sun exposure, if there's not too thick of a marine layer that's clouding it.

Jason Prall: Yeah, yeah.

Ari Whitten: But yeah-

Jason Prall: But even that's good. I mean, well, not good necessarily, but I came from Seattle and I just want to make that point too, that even in cloud cover or haze, we're still getting surprisingly amounts of light.

Ari Whitten: Yes.

Jason Prall: And our eyes can tell the difference, and our skin.

Ari Whitten: It's still orders of magnitude greater than indoor environments.

Jason Prall: Right. So it doesn't have to be a bright sunny day for us to take advantage?

Ari Whitten: Yeah. So yeah, and going back to the beginning, there's different mechanisms and different parts of the spectrum.

Jason Prall: Right.

Ari Whitten: So you can be in a cloudy environment and still get adequate stimulation of the circadian rhythm, because you're getting bright light through the eyes, but you're probably not going to get much UV light in terms of synthesis of vitamin D and cholesterol sulfate and heme oxygenase and some of these other compounds.

Jason Prall: Right, cool.

Ari Whitten: But certainly the circadian rhythm component by itself is huge. So the last thing I want to mention just as a quick bonus, a fun fact, is methylene blue. Methylene blue is, I think, I believe it is technically the world's oldest drug. And it was, I think back in the 1800s, that they developed this. It's been around, it's been used in microscopy, where they stained tissues to look at them under a microscope. I used it when I was a little kid growing up because I was big into aquarium, so I used to use it to treat diseases in my fish, parasitic diseases. And it's really beautiful the way it interacts with water, just, I was always fascinated by it when I would put it in my aquarium.

But there's some really fascinating stuff that's come out on the topic of methylene blue and how it interacts with light. I'm going to keep this one very short, but basically there is actually research showing that ... I'm going to do this one first. Showing that methylene blue plus light exposure, and it's the part of the light spectrum that activates methylene blue is the red-light part of the spectrum, so from about 600 to 700 nanometers. So red light therapy devices would do this very effectively or sunlight exposure. There's a number of studies showing that methylene blue plus that light exposure, when it's in blood and there's viruses present, that methylene blue plus light exposure inactivates those viruses, many, many different types of viruses, in a matter of minutes.

And this has already been shown to occur with coronaviruses in particular, and with SARS-CoV-2. This study shows that BX-1, which is basically a type of methylene blue, can effectively eliminate SARS-CoV-2 within two minutes when put in the blood and exposed with red light therapy. So this is very speculative. It's actually, there's a study currently studying this as a treatment for SARS-CoV-2 for COVID-19, and there's doctors who are already using it. But the research hasn't come out at the time we're recording this, but in the context of the bloodstream and in cells, which this type of light can actually penetrate through the skin, inches deep into cells and into the blood, when you have adequate

levels of that light and methylene blue, it can potentially inactivate viruses including SARS-CoV-2.

So again, I'm not claiming this as a cure for it. It might be. It's possible that it could actually be an incredibly effective treatment. I have a hunch that it might. But as of right now, technically the research hasn't come out. I just think it's a very interesting potential side benefit. And the one caution I would have is just, if you're on any prescription drugs, be aware of any potential interactions with methylene blue. But outside of that, methylene blue is incredibly safe and red-light therapy is incredibly safe. So this is something that I've been experimenting with in my own life. And I have my family and close friends doing as well.

So that's the summary of light and immune health. So four critical ways that light combats respiratory infections. So vitamin D and all the mechanisms around that. Other ultraviolet mechanisms like heme oxygenase and nitric oxide, the melanocortin system and cholesterol sulfate, can potentially combat COVID-19 or bolster the system in various ways that prevents severe outcomes. And melatonin and the melatonin mitochondria and glutathione link, and how that ties into immune function and fighting off pathogens and preventing severe outcomes. And little bonus of methylene blue and phototherapy. So that's the talk, that's the whole thing.

Jason Prall: Wow. Well, look, you got a lot there. We covered all different spectrums of light. And I know you even left out some of the stuff that you know about red light and infrared light, because you wrote a whole book on that. And I would recommend people go check that out, because it's actually a really easy to read book. It's not some super huge thick book, it's actually quite readable. And it's the language in there, isn't super confusing. You've got great diagrams. So that's one of those things I'll leave there.

But red light, infrared light impacts mitochondria. So it really seems, this whole subject seems to have a very, very strong interaction with mitochondria.

Ari Whitten: Yes. Most definitely. Yeah, I think it does. I think the glutathione stuff is really fascinating. I think the fact that mitochondria have this critical role as a central hub of the immune system, seems to be almost unknown and hardly talked about by anybody, even people who are talking about the immune system. And they haven't necessarily even connected it with what we know about mitochondrial health, what you and I know about how to optimize mitochondria because there's an issue with siloed expertise. The people who are immune system experts, like virologists and immunologists and infectious disease epidemiologists, and emergency medical doctors and these types of people, they don't necessarily have any knowledge of natural health. And how things like diet and exercise, and sleep and circadian rhythm optimization, and fasting and sauna exposure and cold exposure, and how all those things are actually the critical pieces of what creates robust, healthy mitochondria, and how that ties into the immune system.

Everybody's looking at things in a very siloed way. I'm really big into systems-thinking and putting the pieces together. And so I'm not in an infectious disease epidemiologist, and I'm sure if I was debating an infectious disease epidemiologist on the topic of infectious disease epidemiology, I probably wouldn't do that well. But if they were debating me on nutrition and lifestyle and the practical strategies to optimize immune health, I pretty sure they wouldn't do very well. So, what I'm trying to do is develop knowledge in the areas that I don't have them, and then connect the dots with the foundational stuff of what really creates robust health.

Jason Prall: Yeah, no, I love that. And we brought on Dr. Jockers. And you, and I know him well in terms of metabolic health, that's what he really focuses on in terms of intermittent fasting and exercise and sleep. Those are the three big ones we talked about. And as you alluded to, those three things, of course we can't isolate anything. It's all happening to the whole system, those impact the whole system, but those are three main factors when it comes to mitochondrial health. And of course the metabolic system itself is fundamentally tied to mitochondria.

And one thing we've heard over and over again through the media and the social media, is how much the SARS-CoV-2 is related to obesity or poor metabolic health. And it's, I'm sure every time you hear that, you're like, "Well, yeah, because mitochondria."

Ari Whitten: Mitochondria, and I would also point out vitamin D. So the number one risk factor is age. We know that elderly people have lower vitamin D levels and have more difficulty making vitamin, D they require more sun exposure to make adequate levels of vitamin D. And obesity is the second biggest risk factor for severe outcomes. And in obesity, it's also linked with low vitamin D levels. The mechanism is still somewhat debated, but it's likely that having excess fat on your body soaks up some of that vitamin D, leading to lower blood levels of vitamin D.

So yeah, we know that both of those two biggest risk factors for severe outcomes tie into immune senescence, tie into poor mitochondrial function, glutathione deficiency, and mitochondrial damage and low vitamin D levels. So there's probably many different layers of how those things are translating into increased risk.

Jason Prall: Yeah, absolutely. And this is one of the big frustrating things that I keep coming across when it comes to the public health experts telling us what we should or shouldn't do, this idea of staying home and inside. And down here in San Diego, we weren't able to ... Well, we were able to go to the beach after a while. For a while, we couldn't go to the beach, that was off limits.

Ari Whitten: I heard it was three months where it was closed.

Jason Prall: Yeah. And then they let us on the beach, but we couldn't stand still or sit, we had to keep moving. So it was just this weird thing. And I'm thinking the whole time, "Boy, I mean, we live in one of the sunniest climates. This is exactly what we need to do, is encourage people to go outside." So it flies in the face of what we've been told. And I think this is why it's so important for people like you to come out here and share this stuff, because you're really, really explaining ... It's actually deep science, but it's in a sense we don't need to know the science. We should intuitively grasp that going outside and getting light and this is how humans have always lived, that there's something beneficial.

But I think a lot of us, and I would put myself in this camp, sometimes we need, or we benefit from an explanation of something. How it works, why it works, what's going on, to help just ingrain it in us, how important it really is.

Ari Whitten: Yeah. Well, on that note of ... And I agree with you completely that education and understanding some of these mechanisms of how sunlight interacts with our physiology in profound ways, I think is the key to making a change. If we just say, "Hey, get your sun because of vitamin D." Then it's like, "Ah, screw the sun. I'll just pop a vitamin D pill. I don't have time for sun."

But as I hope I've been effective in arguing, that that doesn't work and you're missing out on so many amazing benefits by not getting adequate sun. And again, most people aren't getting anywhere close to adequate levels of sun. I mean, if you're very pale skinned then you have a little bit of advantage, because you might only need five or 10 minutes a day. But the darker your skin, I'm middle of the spectrum, more olive Mediterranean skin, I require quite a lot of sun. And I absolutely notice that during the winter time, my health, my energy level, everything declines considerably for a few months if I don't get that sun. And so it's always nice to vacation to a tropical place and kick everything back into gear and get some sun exposure.

But yeah, I think the one thing that ... Maybe to emphasize the point on sun exposure more broadly. There was a study in Sweden that followed nearly 30,000 Swedish women over the course of several decades. And they ultimately found that low sun exposure was as big of a risk factor for all-cause mortality as smoking a pack of cigarettes a day. So if you want to quantify the magnitude of how bad it is for you to not get adequate sun exposure, that was the lowest level of sun exposure compared to the highest, it's the equivalent of smoking a pack of cigarettes a day. So it's pretty bad for you to not get adequate sun exposure.

Jason Prall: Well, and we were only able to squeeze in a number of mechanisms here, but you did cover a lot. And I do appreciate that. Ari, where can people find more about your work?

Ari Whitten: Yeah, theenergyblueprint.com is the best place to do that.

Jason Prall: Perfect. Well, you've got a book out there, you got ... I think, and you're working on a second one here. You've got a lot of great material, you've got a course. You've got a lot of things that I think people can benefit from. And we share a lot of the same philosophies when it comes to health, so I really do appreciate everything that you're doing. Thanks for joining us today on the Immune Resiliency Summit.

Ari Whitten: Yeah. Thanks for having me, brother. I appreciate it.