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| Mark Pettus: | **The Health Edge****Mark Pettus MD and John Bagnulo PhD, MPH****Light and health****Show Notes** |
|  | Welcome to the Health Edge! Translating the science of self-care, bringing you news to use. I am Mark Pettus and really glad to be with you from the Berkshires in Western Massachusetts. As always I am joined by my friend and colleague John Bagnulo. John, good morning. Great to see you. |
| John Bagnulo: | Great to see you, Mark. |
| Mark Pettus: | We've got what I think is a fascinating topic to dive into today, John, that I know our listeners are going to be very, very interested in. It's this fascinating relationship between light exposure and human health. |
|  | I think as we both have looked at this science, John, there are some remarkable research, some of which is 100 plus years old that, when translated in a contemporary, public health lens would lead one to believe that sunshine and full spectrum light is something to be feared and avoided at all costs. We are going to take a slightly different perspective on that message. |
| John Bagnulo: | Yeah, it's really an amazing topic that just embodies so much of what we routinely come back to, right? Which is that lifestyle or pattern of living, however you want to describe it, that most closely resembles the environment that our ancestors evolved in and that really carved our genetics. That's what this is about more than anything else. |
|  | It's really a great model for the importance of balance. We know about the importance of balance with diet and with nutrition, that you have to have certain components there and it's no different with light, Mark. That's what really, I think, is most fascinating about this is that if you have just one component or one area of the light spectrum, that type of imbalance really causes problems with our own internal ... |
| Mark Pettus: | Yeah, that ... I Lost your last few words there, John, on the audio, but yeah, I think as we have framed so much of the chronic, complex disease epidemic to changes in our modern environment in much the same way that junk food is a problem for people, we know that junk light is a problem for people as well. |
| John Bagnulo: | Yeah, I don't know how many people know what junk light is, Mark. We may have some listeners out there that if they go into a big box store where everything is those very, very narrow spectrum fluorescent tubes, right, the fluorescent light tubes ... We may have listeners that they go into those stores and they get a headache or they feel maybe a little off. If they tell somebody about this, people might think they are crazy. |
|  | I remember as a kid, I remember meeting people that would tell me that when they got under certain lighting that they had headaches. As I got older and older and I started thinking more about it, it made sense that you've got these very, very unique lighting conditions in some of these stores and industrial settings. I think with what we are talking about today it really all comes full circle. |
| Mark Pettus: | Yeah, definitely. People probably don't realize how lighting impacts their health. In general, I think we tend to be less aware of the quality of the lighting in our environments and how they impact human biology. You go into those big box stores, John, and the next thing you know you're buying something you don't need. You can't think straight. You're digging into your wallet. It is interesting when you start to look at how our thinking, cognition, behavior, so much of that. |
|  | Maybe a good place to start with is, John, is some of the basic qualities of lights. We talk about spectrum and I think most people can relate to light spectrum going back to our school days and biology and physics and holding a prism up to sunlight and seeing the spectrum from the ultraviolet blue end of the spectrum. We would remind our listeners that that end of the spectrum has shorter wavelengths of light. Then you go through that rainbow, right? The greens, the orange, the yellow, the amber and then on the far end the infrared red end of the spectrum where the wavelengths of light are much longer. |
|  | Sunlight, as the gold standard, has this, as only nature can design, this beautiful smooth and balanced representation from the blue ultraviolet end of the spectrum to the near infrared red end of the spectrum. One aspect of light quality that you and I will be frequently touching on is the extent to which that balance is represented in other forms of light that we're frequently immersed in. The spectrum, I think, is one important aspect of light quality. |
|  | Another aspect of light quality that we'll touch on, John, just to set the stage, is what is referred to as color temperature. Temperature, color temperature, as I think about it, the higher the color temperature, the more toward the blue end of the light spectrum you are. Higher color temperature tends to be a bit brighter light. Many of the default settings of our smart phones and our laptops are designed for higher color temperature. As we will touch on over the course of the podcast, John, there may be instances where that's advantageous, but there are many instances where, over the course of the day, and certainly into the evening and night, where higher color temperatures can be problematic. |
|  | The last aspect of light quality that jumps out when I review the science, John, is sort of the intensity of the light, the lumens of the light. When you look at the research in problems like seasonal affective disorder, and when so many people notice changes in their mood an energy over the long winter seasons, particularly if they live at more northern latitudes, the intensity of the light, which tends to go down over those winter months, we know can also impact human health for some. The lumens, or intensity, can be an important quality of light as well. |
|  | When we think about color spectrum, we think about color temperature, we think about color intensity. These are all qualities of light that - we'll present some science and research - that can impact human health in very significant ways. Again, looking at some light is our gold standard. That, I think, are just some qualities of light that are important for people to keep in mind. |
| John Bagnulo: | Yeah, absolutely. Just so everybody that may be thinking about this more deeply for the first time understands, there isn't a plant or an animal on the planet that isn't somehow dependent on sunlight and/or these various components of sunlight. Whether it's in the field of botany and looking at a plant's requirement with photosynthesis, and again, plants can ... The vegetative stage in a plant is predominantly driven by blue and green light wavelengths. Then, for that plant to flower, for the maturation process to take place, it requires the red and yellow spectrum. |
|  | With mammalian physiology, we know that we also have these core requirements for light. We're going to dive into those this morning, but whether you're talking about neurological health and our outlook on the typical day or the world around us, we know that that's certainly influenced by light intensity. You talk about seasonal affective disorder, but whether it's our mood or the hemodynamics of our blood and our circulation, that's also influenced by different components of light. |
|  | It's really incredible that when you look throughout the plant and animal world and you look at mammalian physiology, we have requirements for all these different components of light. Most people, Mark, are lathering up with sunscreen or sunblock, they're spending all their time inside for the most part. They're under very, very narrow spectrum compact fluorescent bulbs, which, you know, you're calling junk light, which I think is great. We've got this enormous void in components of light. |
|  | The other thing that I'd add to that is that most people are familiar with ultra violet, but they don't understand that there's UV A and there's UV B. They penetrate at dramatically different depths of the skin, and they produce different changes. Again, it's just another qualitative aspect of light, but it is imperative for life. People will say, "Well, I haven't drank enough water today. I haven't had enough fiber today. I haven't gone for a walk today," but how many people say, "I haven't had natural light today?" |
| Mark Pettus: | Yeah. Those are such great points, John. We'll look in a little more detail at the importance of UV A and UV B. To your point, John, about all of life on this planet is inherently connected to sunlight and biologically requires, and in some respect, is a manifestation of sunlight. That's the other sort of aspect of this discussion, sort of that metaphysical ... All ancient traditions refer to human life as light and light sources. One of the things that we'll touch on today to emphasize the point that you just made is that we are beings of light. Much in the same way that plants and photosynthesis, and chloroplasts have evolved to fully leverage that relationship, there are many biologic systems in human beings that have evolved in much the same way. We have our equivalent of chloroplasts in the mitochondria that we'll touch on. They're very in tune to certain frequencies, wavelengths of light within that full light spectrum. |
|  | Whether this is philosophical, metaphysical, or whether you're really getting into the biochemistry, it's just such a fascinating relationship and one that we would all benefit from being more conscious of. |
|  | A good place to move from here, John, is I think about this ... There are basically two ways in which light, in general, interacts with human beings. One is through our eyes and through our retina, and I would remind - this may be stating the obvious - I would remind our listeners that the eye, our pupils, are really one place in the human body where the outside world can directly interact with the human brain. Our retinas are really part of, an extension of, the human brain. We have these really specialized and highly refined cells in the retina that are unlike any other cell in the human body. Rods and cones that help us manage color and interpret patterns. |
|  | We also have an interesting group of cells that were really only discovered about 20 years ago called melanopsin. Melanopsin are these cells in the eye that specifically, in the retina, that specifically are adapted toward blue light, toward that blue end of the light spectrum. One of the ways in which melanopsin appears to function is it signals to the brain what the quality, or presence, of that blue light is. We know that these signals from the retina quickly go to the brain, what we call the suprachiasmic nucleus, which is, sort of right where all of the signals from the eye come together and root to brain's signaling. |
|  | There are two parts of the brain that I think are central for people to at least be aware of. One is the pineal gland, p-i-n-e-a-l, the pineal gland. This is a very small and subtle area of the brain that is pretty central anatomically in its location that produces melatonin. This is the primary signaling aspect of the brain that tells us that we are shifting, for example, from day to night, from more blue light to less blue light. It's that sensitivity, that surge in melatonin, that we know not only induces more quality sleep states, but melatonin does so much. It protects us from cancer, from oxidative stress, it lowers inflammation. Part of the reason for emphasizing that is that design is one that when the stimulus is right, those hormonal, those circadian hormonal rhythms remain in tact. When the quality of light impacting our melanopsin areas, the superchaiasmic nucleus, and then ultimately to the pineal gland, are not in balance, one will start to see disruption of melatonin and all of the many downstream effects of that disruption. |
|  | The second part of the brain that's central to this story as it relates to the eyes is the pituitary gland. We often touch on the pituitary gland in the context of this HPA axis, the hypothalamic pituitary adrenal axis. This is really, in many respects, mission control for regulating virtually all of the hormones in our body, from thyroid to cortosol, to adrenaline to sex hormones. The interaction of light via the retina into the brain will have implication for not only melatonin and pineal gland function, but for pituitary gland function, and all of the biologic systems in the body that are influenced by that. |
|  | They're just elegant systems that have far-reaching biologic importance that are highly evolved to be in relationship with the quality of light that hits our eyes as interpreted through our retina. That's one area that I know we'll come back to, John. The other area is the skin. We have our eyes and we have our skin. The skin, we often remind folks, is the largest organ in the body. Tremendous surface area. Isn't it interesting that this large blanket of active human tissue is designed to be in perpetual relationship with the light in our environment and has highly evolved biologic systems that, when stimulated by light, can induce lots of function. |
|  | We've got brain, we've got skin, and I think those are two really important systems, John, as we look at how light spectral quality and light intensity and color temperature, both in the eye and the brain, and both via the skin, can impact those systems. Again, function follows form. The relationship of light or retina, brain, nervous systems, all of the neuroendocrine immune, and certainly the many ways in which skin serves us. Perhaps eye opening, metaphorically and physiologically for people to sort of contemplate what's happening when they're exposed to light in both of those systems. |
| John Bagnulo: | Yeah. If I could just go back to what you said about the first series of mechanisms, which are taking place through the eye, if someone is repeatedly looking at their smartphone or is always in front of a computer screen, or is under these, what we call, junk lights, these compact fluorescent lights of high intensity, typically blue, green wavelengths, then that series of chemical reactions that affects the pineal glad is always basically turned on and melatonin production is turned off. |
|  | There are studies that go way back to the early 90's which showed that people who worked a third shift basically are up all night. They sleep during the day. They are only under those junk lights because of their working conditions at night. Women, for instance, have a much higher rate of breast cancer when they work the third shift. Melatonin, as you mentioned, it influences a lot more than just our pattern of sleep and our health in that way. It influences the body's immune system and is a really potent antioxidant. When you are keeping that pineal gland turned off with this high intensity blue white light all the time, you're asking for trouble in a lot of different areas. I thought that was great how you really summarized that, Mark. |
|  | It's important for people to get this blue light early in the day for circadian rhythm entrainment. You can shut the pineal gland off in the morning by going out for a half an hour walk or so, in the early, early day light when it's higher intensity, but then you've got to have something at the other end. You've got to have the book end, and that's where the red light comes in. That's where you have to circadian rhythm entrain your sleep patterns with that red area of the spectrum, which you could use a red light or you could use the later part of the day when the sun is going down. Most people don't have those bookends, right? They have the blue light and it's on all the time, and then they wonder why either they can't fall asleep or their sleep is so fragmented. |
|  | For people who have lived in northern latitudes, whether it's Maine where I grew up, or people further north of that, just about everybody who is in any way listening to their body or paying attention to their patterns of living at all will tell you that they start sleeping better and get higher quality of sleep in the spring when they finally start to get some of these different components of light. It is a long winter for many of us in northern latitudes. That's just an observation I think people have made over the centuries. When you start to get those longer days in the spring, it's like everything starts to click, whereas in the winter, a lot of people feel off. You start looking at the incidents of different diseases as they relate to line of latitude, and it's really, again, for lack of a better expression, it's very eye opening. |
| Mark Pettus: | Really important points, John. We have touched on many, certainly many cancers are much more prevalent as you get to northern latitudes. Certain autoimmune diseases like multiple sclerosis have clearly defined changes in prevalence as you go from a more equatorial latitude of low prevalence to very high prevalence at more northern latitudes. You mentioned much of the research on women, in particular, who are at risk of breast cancer. That risk can be two, three, four times greater when you are working night shifts and have disrupted circadian rhythms. |
|  | When we talk about, for example, John, full spectrum light exposure over the winter months to help with seasonal affective disorder, it really is more of that blue light, that higher color temperature, that in early morning, can begin to reset many of the neuroendocrin hormonal mechanisms that can definitely change our mood, change our energy levels, and improve our sleep patterns. |
|  | As we come back to this fundamental point of the spectrum of light, blue light being an example of something that we really need more so in the early part of the day, it shuts our melatonin off. That's what you want when you're ready to hunt and gather. It turns up the pituitary ACTH, this adrenocorticotropic hormone, the adrenaline, the cortosol. That's what you want to happen, as that ramps up, as you get ready to hunt and gather. Toward the end of the day we want to achieve just the opposite. |
|  | I'm thinking from here, John ... This is where I think we need to significantly challenge many of the public health messages as it relates to skin cancer and sun exposure. As we shift from the pineal gland and the pituitary gland in the brain, and the importance of spectral quality blue light earlier in the day, red, orange, amber light later in the day, but presence of both of those spectrums throughout the day - it's just a matter of balance - is a critical area and can be leveraged for health. We'll come back to some recommendations as we wind down. |
|  | Then there's this whole fear of the sun, right John? I've been taught, and doctors today, the public health message is still very much that you need to avoid direct exposure to sunlight at all costs. Your risk of skin cancer will go up. Lather up, stay covered, and I see people all the time, John, even when they're outside, which is not much, they're indoors most of the time. When they're outdoors, they get very little sun exposure. That whole skin cancer sunlight exposure epidemiology needs to be, to some extent, called into question, John. I think we're giving people the wrong message. To me this is the equivalent, and maybe even worse, than recommending, for example, low fat diets, or calorie counting as the best methodology for managing your weight. I think we're going to soon learn that the public health message to stay out of the sun at all costs could be one of the worst pieces of advice out there. |
| John Bagnulo: | Yeah. It's one that I've been personally, not professionally, but personally I've been battling this for my entire life. I've had people tell me since my college days that I need to stay out of the sun. They'd say that my skin was pink, or it looked like I'd been out in the sun for the previous week with a lot of exposure. I've always said, I think humans would be different if we weren't meant to spend time out in the sun. Just understanding just the basics when I was back in my 20's or 30's about things like UV B and vitamin D production. |
|  | You're absolutely right, Mark. I think when you really take a look at this, it maybe is more damaging from a public health perspective to tell people to fear the sun, stay out of the sun, always wear sunscreen or sunblock. It may be more damaging than telling people to eat a low-fat, high carb diet. It'd be hard to choose, but I think, I would agree. I think it is more damaging because life has more prerequisites that are tied to components of sunlight than it does to components of the diet, believe it or not. |
|  | When we start to talk about the different angles that people take on this from a public health perspective, the most basic angle is that people say light is mutogenic. Your ultraviolet light, your infrared light, they've been shown to be mutagenic to the DNA within our cells. That initiates cancer, and isn't it a direct line of reasoning to say that if something's mutagenic and it has the potential to cause genetic damage because of it's intensity within our DNA that it must be a bad thing? As you and I know Mark, there's various components to what we call eustress, which is a positive in the end, a positive stress that's placed on our physiology in one way or another. While this ultraviolet light and the intensity of some of the light spectrum may in fact be mutagenic, it's like you have to eat to find energy. When you eat food and your mitochondria create ATP from it, there's a stress. Those are called free radicals that are generated during the metabolism. |
|  | It's no different with sunlight. When you have exposure to sunlight, yeah, it does cause, with prolonged exposure, there's certain types of mutations that take place. What most people don't realize is that those mutations are not tied to malignant melanoma, like they might be more superficial or more topical forms of skin cancer, like basal cell or squamous cell cancers. Malignant melanoma is not tied to UV B exposure, for instance, which is a shallow type of sunlight exposure damage that causes a burn. What malignant melanoma is tied to is the UV A penetration, which is a much, much deeper penetration and it can cause mutations much, much deeper in the dermis, or below the dermis. Again, we could spend a lot of time talking about the skin, but the skin is a transparent organ. It allows certain components of light to penetrate much deeper than most people think. It doesn't just hit the surface and cause damage there. |
|  | When you take a look at the research really closely, what is the form of skin cancer most people are terrified of? It's malignant melanoma. There's no ... There is no association between sun exposure and malignant melanoma. In fact, you'd find papers that show people who spend the most time outdoors in the sun have the lowest risk of malignant melanoma. People who spend the most time indoors, either behind glass or under compact fluorescent or fluorescent lights, they have the highest rate of malignant melanoma. Then when you start to look at the physiology, effects of different components of light, you see that UV A penetrates much more deeply, which is where malignant melanoma will originate. Again, if you're spending time indoors, the glass will protect you from UV B. Protect is not the right word, but glass, polarized glass or otherwise, will keep UV B from reaching your skin, but it will allow UV A to reach your skin and penetrate deeply. |
|  | Once you start having a predominant amount of UV A exposure and not enough UV B exposure, what you are doing is keeping an anticancer mechanism turned off, which is generated by UV B. That's the sulfation that we've talked about, not just generating sulfated vitamin D, but generating sulfated cholesterol, which is water soluble and can be used by cells to repair damage. You've got a major compromised component of physiology when you have only UV A exposure, not enough UV B. When people start to talk about cancer, and skin cancer in particular, they're telling people to stay out of the sun, I think they're doing people a huge disservice. I think what people should be told is be careful how much time you spend indoors behind glass. Be careful how much time you spend under these junk lights. Get outside and get some real full spectrum light, and hopefully you'll restore balance within your skin. |
|  | As you mentioned, Mark, this is the exact antithesis of what people are being told. Most people's appreciation for the sun has only to do with vitamin D. Most people are told you need a little bit of sun to generate vitamin D, but they're not told about the other benefits, which hopefully we can get into now. The benefits with our mitochondria, other anticancer properties that are generated by infrared light. It is really ... The whole thing gets turned on its head, and I think a lot of people, when you start to talk about getting more sunlight, they're beyond the sway of reasonable argument because they've been bombarded for 20 years, either from their dermatologist, or from Shape Magazine, or some periodical that will tell them how to take care of their skin. Most people are terrified of the sun. It's really, it's bizarre. |
| Mark Pettus: | It's definitely in the universe of bizarre, John. Radical as this message comes across, I think you and I would both recognize that, like everything in nature, there's an optimal dose of sun exposure. Even our hunter-gatherers knew that there were certain times of the day they want to find some shade, some cooler temperatures. We're not suggesting people go out and burn to a crisp, but if you start looking at an hour a day of quality peak sunlight, you're going to do much more to reduce your cancer risk throughout the body. We talk about skin cancer, but to your point about melanoma, John, most melanomas occur are non-sun exposed parts of the body. There's some really interesting epidemiology that more light exposure reduces cancer risks in other ways, from lymphoma to solid tumors. |
|  | Just to emphasize what you were saying, John, we're giving people, I think the exact opposite advice to what they should be doing. Many people are probably being harmed in ways that they don't realize. When you look at the skin, the skin is a very dynamic organ. Even clinicians don't always think of the skin as an organ, John. It's sort of perceived as this protective barrier, which indeed it is. But this is a very active biologic organ. |
|  | We talk about UV B and vitamin D exposure, and we spent a lot of time talking about vitamin D and the epidemiology that clearly would suggest that low vitamin D levels are associated with many chronic complex diseases, from obesity to diabetes, to depression, to cancer, autoimmunity. Sulfation, this critical biologic process of attaching a sulfur group, totally changes the biologic availability and function of that molecule. Getting vitamin D through UV B exposure may be very different than getting vitamin D by a supplement. The vitamin D alone, and one could look at vitamin D as a signaling molecule. We know that vitamin D has super secret, high security access to the nucleus of every cell in our body, and will regulate as many as a thousand plus genes in our book of life. I think that list continues to grow. |
|  | Here's an example of how the quality of exposure of UV B light in our skin creates the synthesis of sulfated vitamin D, that can then throughout the body have access to every cell, totally change the translation of those genes and how they're expressed in those cells. This is a mechanism that would suggest tremendous importance of vitamin D from that source as a signaling molecule communicating to the rest of the body what the quality of the light in the environment is, that that living being is in. To be purposefully recommending that people do all that they can to inhibit that process should definitely create pause. |
|  | We talk about vitamin D, we talk about sulfation. |
| John Bagnulo: | Mark, it's the same, just interrupt quickly. Most people hear the word heparin and they think of the synthetic form that might be given as a blood thinner, but your body has to produce heparin naturally. Heparin sulfate, again, is going to be dependent upon the process of sulfation which is driven by exposure to UV B. If we want our blood to be at the right viscosity and we don't want to be at an increased risk for forming clots, it's, again, it comes down to exposure to full spectrum light. Sorry, I didn't mean to interrupt you. |
| Mark Pettus: | That's beautiful, John. We look at UV A, and again, these are on the ultraviolet end of that light, that blue violet end of the light spectrum. UV A has these fascinating effects, John, on nitric oxide. The simple molecule nitric oxide, a nitrogen and an oxygen, which is liberated from a bound form to a freely circulating form. We often talk about nitric oxide as a critical vascular signaling molecule. Nitric oxide will take our endothelial cells, the lining of all of the capillaries in our body, and it will help them dilate. They become more distensible. Blood flow, oxygen delivery, so many things we know are influenced by nitric oxide. UV A light exposure is a critical mechanism whereby nitric oxide is liberated. |
|  | Most people, to your point, John, associate UV B and vitamin D, but nitric oxide is another important player in this story. |
| John Bagnulo: | It is, Mark. On the flip side of that, we know how important nitric oxide is for cardiovascular health. It's one of the reasons people have been told eat more nuts and seeds, because they're very rich in arginine and it helps the body generate more of this nitric oxide. When that nitric oxide starts to accumulate, let's say in particular aspects of our cell like in the mitochondria, it can displace the oxygen that's required for effective respiration or for generating energy from our food. This is, not to get too technical here, but this is called the Krebs cycle. That probably makes some people cringe when they think about that, when they go back to their biology course at some point, right? The Krebs cycle is dependent, of course, on oxygen. Nitric oxide can displace oxygen. |
|  | Here's the cool thing, is that if you have exposure to full spectrum light, and the UV A may be generating nitric oxide, it's the infrared light that can help displace that from our mitochondria. This infrared light can penetrate centimeters into our skin. If you take a look at our surface area based on skin alone, and then you figure that two to three centimeters deep is what infrared light can penetrate, we're talking about an enormous surface area. When you start to take all of those different layers of our physiology that infrared can reach and can affect the mitochondrial health, that's where the Krebs cycle takes place. All of this starts to come together in a really amazing way. You've got UV A to help generate nitric oxide, to help with vasodilation, blood flow, and then you've got infrared light which is going to help maintain that check and balance system so that the nitric oxide doesn't start to overwhelm our mitochondria and cause any type of compromised health in that area. |
|  | It's really incredible when you see the beautiful balance that nature has provided us with full spectrum light, and, as you mentioned earlier, Mark, our skin, is a giant photosensitive solar panel, in essence, on our body. A solar panel that we wear on our back, that we wear on this ... This incredible covering that we have that is so interactive with our environment. This solar panel helps us generate hormones. It helps us improve mitochondrial health, it helps our immune system. It's never ending. It's really incredible. |
| Mark Pettus: | I love that you touch on mitochondria, John. We talk about mitochondria often in the context of all chronic complex diseases where these organelles that, in addition to producing energy from oxidation of the nutrients that we consume, they're so biologically active in other ways. Isn't it interesting, John, that when you look at mitochondrial health and the importance of near infrared red light in promoting mitochondrial health, one of the great changes in the quality of our lighting with fluorescent lighting as an example, is that you're getting mostly the blue end of the spectrum, as we touched on early on. You're not getting nearly enough of the red, near infrared, infrared aspects of the light spectrum. |
|  | When you look at the mitochondria, and again, to get a little bit geeky here, we know that near infrared red light, infrared light, will stimulate cytochrome C oxidase. Cytochrome oxidase. This sits in the inner membrane of that mitochondria. It is taking those electrons, passing them down the chain, creating ATP and energy. It's cytochrome C oxidase that is the final ... It's the recipient of this chain of passing along these electrons, and it's a pigmented molecule in much the same way that chlorophyll or chloroplasts in plants are pigmented. It is specifically stimulated through exposure to the red, near infrared end of the light spectrum. It's fascinating. You are activating one of the most important aspects of mitochondrial function through that exposure. The very design of cytochromes, we talk about iron and heme pigments, these are color sensitive molecules. |
|  | Those mechanisms, I think, are so fascinating, John. When you look at mitochondrial health, and some of the research that's out there, the more red end of the spectrum that we get, there may be significant improvements in cognition for people with cognitive problems. There may be significant improvements in pain and energy that one might see with, say, fibromyalgia or chronic fatigue, or depression, all of which have mitochondrial disfunction as a potential mechanism. You'll see improvements in wound healing. Many years ago it was recognized that if you have somebody with a wound, a burn, for example, and you give them more exposure to light at the red end of the spectrum, you will actually enhance and accelerate wound healing. |
|  | We have this blue light, and the ultraviolet light, which, particularly earlier in the day, can turn our melatonin off, get us ready for the day, rev up our pituitary and all of the hormones that we need to hunt and gather, and defend. We've got UV B and vitamin D. We've got UV A and nitric oxide. Then we get that red end of the continuum where you're looking at mitochondrial function, wound healing, and detoxification. Many of the things that our brain produces, like cortosol and ACTH, is broken down in the skin. It's the red end of the spectrum that helps break that down. It's just another way of articulating, John, as you did, that beautiful, sort of balance of the light continuum and how each has a very unique physiologic action that, in concert, produces the kind of balance, that for most people, is entirely lost with the quality of lighting that they're in. |
|  | Then you begin to connect these mechanisms, right, John? Whether it's low vitamin D, or poor sulfation, or insufficient nitric oxide with cardiovascular disease. Mitochondrial dysfunction because you're getting too much blue light and not enough of quality full spectrum light. Insulin resistance, and obesity, and what about taking that child or adult and the fluorescent lighting that they're under is overstimulating them? They've got ADD, they've got ADDHD, behaviorally they're hyperaroused, they can't sit still. You put them in these environments which just continue to promote those problems. |
|  | The last thing that sort of jumped out at me, John, we talk about eye, we talk about skin, is this shift towards or predominance of blue light sources in our artificial lit environments, we know increases oxidative stress. We talk about oxidation as a dose and needing low levels, this hormetic affect, to keep us primed in much the same way that exercise will do, much the same way that stress can do in lower doses. When you start having predominant blue light exposure, your oxidative stress goes up dramatically. |
|  | When you look at the eye, there's really compelling research now to suggest that this growing prevalance of age-related macular degeneration, which again, is more common now than ever, begging for the question, where is this stuff coming from? These aren't genetic mutations. Some people may have genetic predisposition, that's true for all chronic complex diseases. A compelling case could be made that the over exposure to the blue end of the light continuum, as it affects the retina, overwhelms the retina's capacity to manage that light. This melanopsin, these special cells designed to sense blue light, have a limited capacity. They can't manage high levels of exposure throughout the day. Whether it's the fluorescent lighting we're sitting in, or the light that's coming out of our computer screens or smartphones, I do think there's going to be a lot of interest in risk of age related macular degeneration, and the extent to which people who have age related macular degeneration. The most common cause of acquired blindness in our country may be at least in part at risk because of the quality of lighting that they're surrounded by. There may be really important interventions. We'll bring this home shortly on things that people can consider that can reduce that risk. I think that's really important for people to keep in mind. |
| John Bagnulo: | Yeah, absolutely. Those cells have a limited capacity which they can deal with that oxidative stress. They're just drowning in blue light. That's the best way to describe it. Mark, what are some ways that are most effective, aside from getting outside for a considerable portion of a person's day, whether that be an hour a day for a walk or something like that? What do you think are the most effective solutions for at home? |
| Mark Pettus: | The first thing that I have done, John, like all good stewards of energy, I took all my incandescent lights down and I replaced them with compact fluorescent lighting to be a better steward. Recognizing there are mercury vapors, we haven't even gotten into that, that these lights emit. Mercury will bind to many of these sulfur groups in the skin and throughout the body. That can't be good, even with very low level exposures would be concerning. The first thing that I did was to then take all of my CFU lighting down and put incandescent lighting back in. Incandescent lighting is a much better light source. I think in the balance of energy, carbon footprint, and human health, there's no question the health benefits of incandescent lighting are far superior than the health undermining effects of these fluorescent light sources. That's one thing that I did. I think halogen lighting is good, as well. Incandescent lights, I think, are the way to go. |
|  | I also will use particular colored incandescent lights, John. In our bedroom we've got an amber incandescent light, and after the sun goes down, that's the light source that we use. I've got red light bulbs as well, and I will sort of experiment. The point is that after sundown, I want to eliminate the blue end of that light spectrum. I'll sit under amber lighting, or I will use amber tinted glasses that we have talked about, or I will make sure I have an app in my laptop, if I'm doing any computer work, or smartphone, that will automatically filter out the blue end of the light continuum. |
|  | The other thing that I do, John, and I think most people probably aren't aware of this, I use a Mac laptop. You can go into your ... The default settings, when these computers come out of the manufacturers, their default setting is a color temperature of about 6,000 kelvin, which is bright and it's sort of pleasant to the eye in terms of clarity. Earlier in the day I think that can probably be very, very helpful, or if I have a specific project where maybe I'm working on a graphic and I need a bit more of light temperature. I will set that default from 6500 kelvin down to about 3500 kelvin. We can do that. Most people aren't aware that you can even do that. Shifting that color temperature will minimize, or diminish, the magnitude of the blue light and bring you more into the green-yellow. It doesn't compromise, in any way, the quality of the image you're getting, but it does, I think very much, give the retina and the brain a bit more balance protection. When we talk about oxidative stress and the retina, when we talk about pineal gland and pituitary gland balance. |
|  | That, I think, is low hanging fruit, for people to look at how they can adjust those settings on their devices to enhance the quality of light they're getting, and to minimize the oxidative stress of higher color temperatures over longer exposure times. I think those are the things that I do, John. I have to say, definitely when I'm outdoors, I will wear sunglasses. A little bit less than I might. Not that I'm opening my eyes to full direct sun exposure, but if you're looking at the sun and you close your eyes, if that sun is coming through your eyelids, there's this beautiful filtering of light. I just try to get more of that direct exposure. I try to do that, particularly during this time of year when our sun season is upon us. I'll try to get at least an hour a day. Again, we're not recommending people sunburn, but an hour a day of quality sun exposure is not going to create a burn. The point we're making is that that's where the health benefits are. Those are some of the things that I do. |
| John Bagnulo: | Yeah. That's great, Mark. I think staying medium rare, as opposed to well done, is all it takes, right? |
| Mark Pettus: | Yeah. Fantastic. Yeah. Any other things you would add to that, John? |
| John Bagnulo: | You know, the question I have is can you even buy incandescent bulbs anymore? Can you find those at a ... I'm sure you can find them online, right? |
| Mark Pettus: | Yeah. I got mine online. I can't say that I checked some of the local retailers. They are getting harder to find, and I do think the whole CFU movement is one that I think is another public health problem. Somehow we need to find the balance between energy stewardship and health risk in terms of quality of lighting. I've gotten most of mine online, John, but I can't say that I've looked at some of the local retailers to see to what extent they're easy or not so easy to get. |
| John Bagnulo: | Yeah. I know there has been legislative efforts to ban them. A lot of the municipalities, I'm not sure if it's on a state by state. I think it's actually a federal initiative. I've heard they're going to be disappearing pretty soon because the demand is just so low. |
| Mark Pettus: | Our advice would be to go stock up on them if you can still find them. |
| John Bagnulo: | That's what's funny. One of Britain's leading optimologists, he's been very public in a statement saying ... This is one of the foremost experts on eye health and how it relates to full spectrum lighting. People really need to get out there and get their hands on some incandescents because in Britain anyway, they're disappearing so rapidly. He thinks another year or two you won't be able to get them. |
| Mark Pettus: | Yeah. You know, I would say, John, even candle light. Those sources of lighting, sort of turning the clock back, are probably better than most of the fluorescent sources that we have. I will get some content, John, up on our website, and we appreciate people tuning in. I think this is a podcast that's probably going to attract a lot of interest, and maybe more questions, John. I think there's a lot of research that still needs to be done in this area, but hopefully we've given people a different way of thinking about their relationship with light and the risk-benefit proposition that we've been sold. I think a lot of total BS to rethink that. |
|  | I appreciate people tuning into the health edge. Check us out on iTunes. Give us a thumbs up if you get value from these talks. John, as always, it's a great pleasure buddy. |
| John Bagnulo: | Same here, bro. Take care everybody. |
| Mark Pettus: | You take care, and enjoy the sunshine. |
| John Bagnulo: | You too, thanks. |