The Dangers of LED Lighting: An Interview With Dr. Alexander Wunsch

By Dr. Joseph Mercola

JM: Dr. Joseph Mercola
AW: Dr. Alexander Wunsch

JM: This is one of the most important video interviews I believe you'll ever see. Hi, this is Dr. Mercola helping you take control of your health. Today, we are joined by Dr. Alexander Wunsch from Germany. He is really a world class expert, one of the best I know of, in photobiology. We're going to talk about the dangers, the hidden stealth dangers, of light-emitting diode (LED) lighting that you most likely are not aware of. Welcome and thank you for joining us today, Dr. Wunsch.

AW: Hi, Dr. Mercola.

JM: I'm really excited for this interview. We had an interview a few years ago, and I knew you were brilliant in this area but I just wasn't smart enough to understand the implications of what you had to teach. I've actually grown wiser since our last interview, and I'm really excited about you sharing with us all the important information you have that can get us up to speed in this area.

Because – let me just give a brief summary and then we'll dialogue – but briefly, largely as a result of energy efficiency, there's been a major transition to using LED as a primary light source. And it works, it works on steroids. Literally, it has a 90 to 95 percent reduction in energy power because the older incandescent thermal analogs sources of lighting generate a lot of their light as heat. Most of us believe that was inefficient and wasteful. But it turns out that heat is actually infrared radiation and may be very beneficial for us. Yes, it costs a little bit more but it might be hugely beneficial.

There are some major downsides about LED lighting that we just don't appreciate. I know I didn't. I was massively exposed to this. This may be one of the most important, non-native EMF radiation exposures that each and every one of us has. If we don't take control of this, we are looking at some very, very serious long-term complications, the least of which is age-related macular degeneration, which is the leading cause of blindness in the United States, and then cataracts, of course, too, and other foundational mitochondrial dysfunction components.

What we want to focus on today are the dangers of LED lighting. Why don't you — I sort of painted the broad canvas there, Dr. Wunsch — if you could give us some background information that will help us get up to speed on some of the foundations we need to understand to appreciate the dangers of this. Obviously, we'll focus on the last part of this interview with practical things that we can implement.

AW: How to begin in this large field? The first question we should raise is, "What is light?" It's not so easy to give an answer to this question, "What is light?" Do we take into account only what our eyes can directly perceive? Then we are in line with the standards, which are applied to our artificial light sources at the moment, which means there is a definition.

Light is only between 400 nanometers and 780 nanometers or so. This is even shrunk down to 420 to 630 nanometers U2 efficiency reason. There is much more about light. It's more than vision. When we look at the sunlight, we have a much broader spectral range, from somewhere around 300 nanometers up to 2,000 nanometers or so.

For our energy efficiency calculation, it makes a big difference if we are talking about this broad natural range or if we are only talking about what our eyes directly are able to transmit in terms of vision performance. And so, it was kind of preset, given in the 1930s, the definition that we are only looking at the visible part of the spectrum. This led to the development of energy-efficient light sources like the fluorescent lamps or what we have nowadays, the LED light sources, because they are only energy efficient as long as you take the visible part of the spectrum.

If we would say, for example, red light for therapy from red light lamps can be used in medical therapy to increase blood circulation, and this is a part we are taking away as long as we only look at the visible part. Physicists think that infrared radiation is just thermal waste. But from the viewpoint of a physician, this is absolutely not true, because in the last 30 years there have been hundreds and hundreds of scientific papers being published on the beneficial aspects of a certain part in the spectrum, which is called near-infrared or infrared-A.

You cannot feel it as heat, and you cannot see it. It's a kind of hidden treasure in the spectral range. This is what I think we have to look at if we want to understand where the difference between the artificial light sources, the non-thermal artificial light sources, and natural artificial light sources like the incandescent lamp.

JM: Excuse me for a moment. I just want a point of clarification here. I'm certainly confused, and I believe a lot of others are. When we talk about infrared radiation, is that both near and far infrared, and what are the wavelengths of that? After you answer that question, if you can perhaps start to explain the difference between analog and digital forms of light sources, because I think that is a really important part of this whole reason that massively factors into the complexity of understanding the scope of this problem or the magnitude of the issue.

AW: We have to discriminate the analog and digital problem from the spectral problem, which concerns these modern light sources. You asked about clarification with regard to the infrared radiation. When you look at the rainbow spectrum, the visible part ends in the red and the infrared-A or the so-called near-infrared begins. Then we have infrared-B and we have infrared-C. In another terminology, there is near-infrared, there is mid-infrared, and there is far-infrared. What we normally would expect from infrared radiation is that we feel the heat, that we feel warm. But this does not apply to the infrared-A, which is the wavelength part between 700 nanometers and 1,500 nanometers.

JM: Wow.

AW: Here you have no absorption by water molecules, and this is the reason why radiation has a very high transmittance. In other words, it penetrates very deeply into the tissue, so the energy distributes in a large tissue volume. This near-infrared A is not heating up the tissue so you will not feel directly any effect of heat.

This significantly changes when we increase the wavelength, let's say, to 2,000 nanometers. Here we are in the infrared-B range and this already is felt as heat. And from 3,000 nanometers on to the longer wavelength, we have almost full absorption mainly by the water molecule and this is heating up. So from a lake in spring, it will heat up in the upper inches and still the water is quite cool down below. This is the kind of natural proof that the longer wavelengths are more or less totally absorbed and transformed the light energy into thermal energy, which is the water molecule movement.

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JM: Thank you for that clarification. That greatly helps to clear certainly my confusion, and I suspect many others, when you differentiated that. I didn't realize the near-infrared had such a wide spectrum, 700 to 1,000 nanometers. Maybe if you can touch on – before going to the analog versus digital discussion – a bit about the importance of the infrared for health, and maybe we could even go into the retina and how it works with respect to priming the cells for repair and regeneration. And really, almost forming this justification to switch with – one of our recommendations at the end is going to be switch back to incandescents, which is an energy hog admittedly, takes up maybe 20 times as much energy as these energy-efficient LEDs. But it's not wasted energy. It's actually coming out in wavelengths that are actually helping your health.

Can you describe at a biological level what happens when we're exposed to these wavelengths from incandescent bulbs or solar radiation from the near-infrared, and how it helps restructure at a molecular basis, our mitochondria, what happens in the retina, and – the other light source I've neglected to mention was infrared saunas. We can have a discussion on that too.

AW: The first question we have to ask is, "What molecules are we addressing?" or what other so-called – In photobiology, you call these molecules chromophores. These are molecules which are capable of absorbing exactly the wavelength you are emitting with the light source.

The first aspect is that we have to consider that there is a so-called optical tissue window, which ranges from 600 nanometers to 1,400 nanometers. So it's almost completely covered by the infrared-A part of the spectrum. This optical tissue window allows the radiation to penetrate deeply into the tissue. When I say deeply, I'm not talking about a millimeter or two. I'm talking about several centimeters or at least an inch or even more. The chromophores in the tissue, which absorb the light energy are – a part of these chromophores is found in the mitochondria and the other part of the water molecules, which are specifically activated. Not in terms of heat radiation, of chaotic molecular movement. The water molecules are specifically addressed.

For example, in the realm of membranes in the exclusion zone, which covers, like sheets, the microanatomical structures within the cells. Talking about the mitochondria first, here we have a specific molecule, which is called cytochrome c oxidase. This molecule is involved in the energy production within the mitochondria.

Energy for cells means adenosine triphosphate (ATP), which is the end product of the correlation of the energy production. This is the fuel that our cells need for almost anything, most for motility, for transporting of ions, for synthesizing products, for metabolism. The ATP production, if it would stop now at the moment, I could survive for another 12 to 15 seconds. My body produces about 85 kilograms of ATP in 24 hours.

JM: Okay. Let's stop there, because I've watched many of your videos in English. You have many more in German. I can tell you that you provide so much information in your videos that I have to watch them three, four, five times. Because you just state things as facts, which is fine, it's just your presentation style. But that is a phenomenally important statement. I'm not going to let that escape and just let people not appreciate what that is. But 85 kilograms or — that's your body weight — we produce in, whatever we weigh in pounds or kilograms, we produce that amount in ATP.

It's just an extraordinary statistic but most people are clueless about. It's a really important concept and the other thing that you mentioned is that, yes, literally we can last about 15 seconds without ATP, 15 seconds. We can go four minutes, or we can go maybe 8 or 10 minutes, without oxygen. We can go a few days without water. We can go for months without food. But 15 seconds without ATP, that's the important thing. That's why we want to focus on this because light is such an important misunderstood part of the equation for energy production, specifically at the mitochondrial ATP level. I'm sorry for interrupting you, but I just wanted to emphasize that because it's really important.

AW: No, no, it was definitely important to highlight this because the cytochrome c oxidase, which is this absorbing molecule, is the last step before the ATP is finally produced in the mitochondria. Here we have this tipping point where light in a wavelength range between 570 nanometers and 850 nanometers is able to boost the energy production, especially in cells when energy production is depleted.

Here we have one important mechanism where this long wavelength part of the spectrum where the near-infrared light is bolstering the energy situation in our mitochondria. And we know today that many signs of aging, for example, they really are the consequence of hampered mitochondrial functioning, and so we have a very interesting and still soft tool to enhance the energy status in our cells, in the mitochondria in our cells, and not only on the surface but also in the depths, regions and areas, of the tissue. This is one important aspect and there are hundreds of papers published on these positive effects.

You can see it in, for example, wound healing, you can see it in anti-aging procedures. There are many applications developed in the meantime where we use this optical tissue window, and we shine through this optical tissue window light in the range, which cannot be found in standard general lighting appliances like LEDs or fluorescent lamps. The cytochrome c oxidase is responsible for an increased production of ATP. This means in turn that the cell, which has better energy supply, is definitely able to perform better. So the liver cell with more ATP will be able to detoxify the body much better. The fibroblast in the skin will be able to synthesize more collagen fibers and so on, and so on. This is one important brick in the wall.

JM: Let me expand on that brick for a moment if I can. This is information that you shared in some of your recorded videos online that we'll have a link to. That literally astounded me. I mean I literally almost fell down when I heard this because I couldn't believe it. We had a discussion about this previously and you confirmed that it was true. This is an important tangent to the point that you've just mentioned.

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It's all about energy production. What I didn't appreciate until I heard it from you, is that maybe only one-third, a measly third, of our energy that we produce – and obviously one of those is ATP – comes from the food that we eat. The electrons that are transferred from the food, primarily the fats and the carbohydrates, are ultimately transferred to oxygen and generate that ATP. But only one-third of the energy comes from that. The rest, two-thirds or so, comes from this light exposure. And if you're exposed to LED lights, as you just mentioned – but again, people may [inaudible 20:36] – LEDs don't have that frequency from 500 to, I believe, 800 nanometers, which is the near-infrared primarily that hit the cytochrome c oxidase and generate the energy of the ATP. Can you expand on that? Because I think virtually no one has this appreciation.

AW: Yeah. I think we have to differentiate between the metabolically used energy, which definitely comes from food intake. But there is a thermodynamic aspect to it as well. When you think about the body temperature – I don't know how much it is in Fahrenheit, but in Celsius (I can tell you in Celsius), it's 37 degrees. And I can tell you in Kelvin, this is 310 [degrees] Kelvin – to keep up this body temperature. It's not only the result of burning carbohydrates in the mitochondria using the oxygen.

JM: Just for a moment, the 37 degrees centigrade or Celsius that you've mentioned is basically body temperature, which is 98.6 degrees Fahrenheit.

AW: 90.6?

JM: 98.6.

AW: 98.6. Okay. This is what I have to learn for the Americans.

JM: Yeah. The Americans. I mean these Americans are still on the imperial measurement system for the most part, but the rest of the world is on Celsius.

AW: To maintain this body temperature, it's not only the result of energy production in the mitochondria. The heat in our body comes in part from the mitochondria, but the major part comes from longer wavelengths in the infrared range, and comes from near-infrared for example, because the near-infrared radiation in sunlight is very present, in incandescent lamp light as well.

This radiation, this energy, this photonic energy, is able to even pass through our clothing because this is one important property of infrared radiation, that it just goes deep and it goes through like the terahertz radiation at the airport scanner, and so on. The radiation can enter the body and then will be transformed into longer wavelengths in the infrared part. They are very important for supporting the temperature level, of the thermal energy level, of our body which is, for all the mammals, a very crucial aspect. A lot of energy comes in the form of radiation and this is supporting our thermal balance more or less.

JM: Okay, good. It's still a little confusing. You had mentioned earlier, there were some German studies that are 60 years old that actually support this concept. The key point to take home here is that it's not just the food you eat, it's the energy exposure that's going to run your metabolism and you need to get that. That's why exposure to sunlight is so healthy. It's one of the hidden keys and many people interested in natural health will at least acknowledge and recommend it. It's part of the recommendations. It's far more important than you can ever imagine.

We're only going to be touching the surface of why it is important today. But we do want to keep our promise and focus on the LED wavelengths. The dangers of LED lighting, which is really a message that has to be shared, we have to sound the trumpets on this one because no one virtually understands this. They get it at night, they shouldn't be exposed to this at night, but it's far more than at night. And part of the problem is the analog versus digital mode of administration of that light. Could you discuss with us the difference between analog and digital lighting?

AW: You probably remember the dimmer we had in former days when we used the incandescent lamp to just dim the intensity. This is something which will not work in the same way with LED lamps. Many of the actual LED lamps are not dimmable anyway because they function kind of different.

If you reduce, for example, for a color changing system you have three different LEDs, a red, a green, and a blue LED, and the intensity of these three colored channels has to be changed in order to achieve different color use, which are perceived by the eye in the end. The control of the intensity output of an LED is realized in a digital manner because it's very difficult to have a low intensity in many different steps.

The dimming of LEDs is realized by a so-called pulse-width modulation, which means the LEDs switch on to the full intensity and then they fully switch off, and then they switch on again. So we have the constant on and off in frequencies, which are higher than our eyes are able to discriminate. But on the cellular level, at least it is still perceivable for the cells. This switching on and off of the LEDs, this is something – you can compare this with the digital states of fully on, which is the one, and zero, fully-off.

This is the way how the LEDs are normally controlled in the intensity, for example also, the backlight illumination of your computer screens or of your TV sets, this causes a flicker, which is not perceivable for let's say 90 percent of the population. But it's still biologically active. And flicker is something that is very harmful to our system because when you think back to the cathodes ray tubes TVs – we call them "flimmerkiste" in Germany, this means "flicker boxes."

When you nowadays are in contact with an old TV set, you might become aware of this intense flicker, because your system in the meantime is trained to look into modern flat screens, which do not flicker in this harsh and crude frequency. This demonstrates that our brain is able to filter out the flicker after a certain while. But this takes a lot of calculation energy in our system. If we have light, which does not flicker like, for example, the incandescent lamp has metal filament and it's glowing, so this is very lazy. It's not able to transmit the highest flicker frequencies in comparison to what the LEDs could transmit. We have even developments where scientists try to transmit information via high-frequency flicker in the LED lighting in the room in order to replace the wireless LAN system, and I think this is really not a good idea.

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I call these LEDs – I like to call them Trojan horses because they appear so practical to us. They appear to have so many advantages. They save energy; they are solid state, very robust, for example. So we invited them into our homes. But we are not aware that they have hidden properties, which are harmful to our system, harmful to our mental health, harmful to our retinal health, and also harmful to our hormonal health or endocrine health.

JM: They weren't even necessarily invited. These are being mandated by federal policy. Not only in the United States, but as I understand, in much of Europe, in an attempt to conserve energy. And they've been effective. I mean from that perspective, we can't just argue with them that this has been an incredibly effective, energy-saving strategy but it's just absolutely ignored the impact, as you're starting to discuss, the biological health.

Maybe you can expand on that, the biological health implications, and then I really want to spend a good portion of the next discussion to the practical take-home recommendations. Because there's a lot – once you understand the basics – there's a lot of things that you need to implement to have a personal strategy to circumvent the dangers that each and every one of you watching this are exposed to.

AW: In order to clarify the dangers in principle, I think it's a good idea to express, again, that the LED, the light emitted from an LED, has not the same quality you would expect from a natural light source. A natural light source normally is a black body radiator, which gives off all kinds of wavelengths in a more or less continuous manner. The LEDs we have nowadays are fluorescent lamps, they consist of a blue LED, a driver LED, and a fluorescent sheet, which covers the blue LED and transforms part of the blue light into longer wavelengths, yellowish light. The yellowish light from the fluorescent layer combines together with the residual blue light to a kind of whitish light, which consists of a lot portion of aggressive blue light.

Blue has the highest energy in the visible part of the spectrum, and produces, infuses, the production of reactive oxygen species, of oxidative stress. The blue light causes oxidative stress in the tissue, and this stress has to be counteracted. We need even more regeneration from blue light, but the regenerative part of the spectrum is not found in the blue, in the short wavelength, part. It's found in the long wavelength part, in the red and the near-infrared. So tissue regeneration and tissue repair results from the wavelength, which are not present in an LED spectrum.

We have increased stress on the short wavelength part and we have reduced regeneration and repair on the long wavelength part. This is the main problem. Diseases come apart in a way our organism is not accommodated to, because we don't have this kind of light quality in nature. This has consequences, the stress has consequences, in the retina. It has consequences in our endocrine system.

What I think we know, or many of us know, in the meantime that the blue light in the evening reduces the melatonin production in the pineal glands. But for example, we have also cells in our retina, in our eyeball, which are responsible for producing melatonin in order to regenerate the retina during the night. If we use LED lights after sunset, we reduce the regenerative and restoring capacities of our eyes. If we have less regeneration, we open the door to degeneration. This is the age-related macular degeneration you were talking [about] before.

JM: Yes, indeed. Thank you for that explanation. I really appreciate it. I just wanted to get into some of the details of the dangers of the LED, and maybe just summarize what you just mentioned, in that these LED digital light sources are primarily focused in the blue wavelengths. They have very little red in them, certainly virtually no infrared. And it's this red infrared that's repair and regeneration mode. If you provide these aggressive lower frequencies, the blue lights, they create these reactive oxygen species which can't be – the damage from them – I mean, we need that. Let's not say that all those reactive oxygen species are dangerous. They're not. Because that's what's important.

I think we don't have enough time to discuss the importance of setting your circadian rhythm and exposing yourself to balanced blue light that's not only has the blue but also has the near-infrared and the far-infrared, like in the morning. That sets our circadian rhythm. You need that. But the damage that somebody, by the blue light, is balanced by the red and infrared so it can repair and regenerate, and everything is just the way it was meant and designed to be.

I'm wondering – because there's a whole range of LED lights out there, we're going to step now a little bit into what you can do with this knowledge. Are there – and many people had this question – you can get cool white, which is the high blue light LEDs which are bright white versus the warm white LEDs. I'm wondering if you can – if there are types of LEDs that do have some of the red and the near-infrared in them or they just don't exist? And another version of this question, are there any healthy LEDs?

AW: Well, there's no easy answer to that.

JM: Like most good questions.

AW: Because when you bought an incandescent lamp, you exactly knew everything about the spectral distribution, for example. You knew that after a thousand hours that it would fail, it would break, stop functioning.

JM: Let me just interrupt you for a moment on this, because there's an interesting component. Everyone knows that the old incandescent bulbs fail in 1,000 hours. That, folks, is by design. There's a movie – a documentary out there. These bulbs can last a hundred years continuously if they designed it that way. It's designed to fail in a thousand hours. I'm sorry for interrupting. I just thought it was an interesting tangent.

AW: With the LEDs, everything is different because there are LEDs outside there where you have high portions of blue in a warm-appearing light, because the blue is masked by high amounts of yellow and orange. There are also LEDs available with lower portion in the blue, which are very close to the spectral distribution of incandescent lamps with regard to the bluish part of the spectrum. It is impossible to tell without measurement. This is the problem with an incandescent lamp. You knew what you would get.

With LED, the layman is not able to tell if it's a tailored spectrum where you have the blue part only masked by excessive parts of other spectral regions. There are different technologies. You were sending me a question, I think yesterday, with regards to a specific company, which produces LEDs with a different technology.

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Soraa, for example, they have violet driver LED, not blue but violet driver LED. And they achieved, by their technology, the red is a little bit more emphasized compared to the standard white light fluorescent LEDs. So there are in fact better and worse LED types around. But the spectral distribution is just one thing, what the customer could use as a kind of information if the color rendering index, but not the color rendering index are A, which only covers the first eight testing colors.

We are interested in the R9 which represents the full reds. And this is sometimes, this information is sometimes given on the package that you have for example, nCRI which is the color rendering index of 95 with an R9 of 97 or so. This is the only sign for the customer that you have a high level or a high index for the R9.

JM: Okay. That is the key thing. Maybe we should have discussed that earlier because these are two important pieces of information you need to understand when you're looking at lighting. One is the CRI you mentioned, the color rendering index. But it should be the r9. And ideally, the goal standard is the sunlight, and that's 100.

AW: The incandescent is 100, and the candle is 100.

JM: Yes. So that's the best. Now you're never going to get that – well maybe never, but you're not going to get it through an LED or halogens – not halogens but fluorescents. You got to know that. The other is the color temperature, which is the incandescence 2,700 Kelvin and then 6,500 degrees Kelvin for the LEDs, which is the really bright white LED. Why don't you talk about that? I guess if you use those two metrics, you can identify healthy lighting. But then we'd still have to address the analog versus digital component. We don't want to be screwing up our cells by getting them these digital signals that they were never designed to be exposed to.

AW: You would have to measure somehow if the LED produces flicker or not. Two years ago, three years ago, it would have been much easier because the camera of an elder smartphone was not so high-tech equipped as they are today. With an old smartphone camera, when you look into the light source, you can see these wandering lines, so you can detect if the light source is flickering.

What else could be a kind of work-around is the slow-mo mode of a smartphone camera, if you film the light source with the slow-mo modus, then you might also see the switching on and off of the light source, just in slow-mo. This is one thing that works sometimes quite well. But it depends on the type of the smartphone camera that you are using. Because the cameras in the meantime, they have an algorithm implemented, which detect the flicker frequency and the light and then changes the shutter frequency of the camera in order to avoid these interferences. So the cameras in the meantime are made in a way that they block out the flicker even if it's there.

JM: Excellent. Can you maybe touch on the color temperature of the lighting source? Because that seems to be another useful tool. Or is it too complex a topic?

AW: The color temperature, in fact, is a useful tool to fool the customer because there are two different kinds of color temperature. The one is the physical color temperature, which means your light source has exactly the temperature in Kelvin. This applies to the sunlight. This applies to the candlelight. This applies to the incandescent lamp light, halogen, and standard incandescent. These light sources are truly that hot, so if the color temperature is 5,500 Kelvin for the sun for example, the sun's surface is 5,500 Kelvin hot. You cannot reach higher colored temperatures using incandescent lamps in 3,000 Kelvin because otherwise the metal of the filament would melt and evaporate, so this will not work. There is a kind of natural limit given by technology.

The other type of color temperature is the correlated color temperature. This means you calculate a lot until you can tell this light source might appear to the human eye in a similar way than light source with a true color temperature of, let's say, 2,700 Kelvin. This is the problem because you can tailor the color temperature however you want to. For example, you have probably seen these filament LED lamps. In the meantime, they are entering the market and they look very similar like the standard incandescent lamp because they have these very thin and elongated LED filaments installed inside. Do you know what I'm talking about?

JM: Sure.

AW: Have you seen them? If you look into these with a grey filter, with a strong grey filter, you can see that you have three cold white LEDs on the screen and then one red LED. Then another three cold white LEDs and one red LED. In fact, this is a cold white light source. But by the additional red LEDs which are integrated into the filament, our eye, and also the measuring instrument, as a result, this appears to be a warmer light. But in fact, on a cellular level and on the level of the retina, the majority of the light is still bluish white, cold white.

This is the problem with the correlated color temperature, that you have a lot of tricks to tailor the value in a way that you still are using cold white light sources, that you've masked the light in a way that it appears warmer to the human eye. But the impact on the physiology is still the same, or more or less the same, as you would expect from a cold white source.

JM: You've got two things. You've got that sort of metrical – not metrical but transition – or deceptive solution or interpretation of the data that these companies are providing. And you also have the digital component, so the LEDs really are not in any way, shape, or form a healthy biological form of life.

Let's talk about solutions now and focus on them. Let me first mention that a lot of what I'm sharing with you is based on mistakes. I'm one of the early technology adopters, and I was one of the first people to really switch out all of my incandescent bulbs for LED lighting.

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When they first came out, it was at least almost 10 years ago now that I had switched over to LEDs, and before that fluorescent lights, full-spectrum fluorescent, which is another deception name. If we have time, I want to talk about that.

But what we want to focus on now is that literally, the danger. There's no question there's danger in LED light exposure all the time of the day, but it's a relative one, so that if you're exposed to LED light and there's lots of biological full-spectrum sunlight through the windows – which is a whole other issue too, that we can talk about because sunlight outside and through the window are two different animals – but if you have that as a component, it's not as biologically dangerous because I believe that that compensates specially with the higher frequencies and the sunlight. But it becomes really dangerous at night.

From this perspective, I haven't changed out all of my lights back to incandescent because they're such energy hogs and really the only ones that I use at night because I have a big house and there's lots of lights and people, contractors and stuff, come over all the time. They leave lights on all the time. It would be crazy. That's just a magnificent and extraordinary waste of energy if they did that. But I never use these lights. I just leave them in there.

But the ones you use all the time that you really, really – this is the take home message of this presentation – is that you have got to switch back to incandescents. And not just any incandescents, these are incandescents that are clear transparent outer bulb. Not the ones that are coated with white to keep a cool white light. You don't want that. You want the 2,700 degree Kelvin incandescent, thermal analog, energy source of that light. It's the only light you use at night.

We're going to insert some of these graphics that you have in your PowerPoint slides that really powerfully illustrate the color spectrum of an incandescent, which has very small levels of blue. I mean it's extraordinary. There's some, but there's not hardly any blue light in that, which is exactly what you want at night. You do not want blue light exposure.

Now personally, it's the only light that I use after sunset. Even then, once the sun goes down, I put on my blue blockers. I neglected to keep them here now because it's the middle of the day, I wouldn't put them on. I call them reverse sunglasses. I don't care what company you get them from. You can get them for under 10 dollars. You can get them and spend 100 dollars for them. Get whatever you like. But the moment the sun goes down, these blue blockers go on even if there's incandescent sources. That's my summary, and I'm wondering if you can expand and really amplify those comments.

AW: It is definitely a good idea to keep away the short wavelengths in the evening, so after sunset, as you said. And it's also a good idea not to intoxicate your environment with too much light. We know in the meantime that artificial light levels at night have reached insane intensity. The candle, the intensity of the candle for example, is absolutely sufficient for orientation.

If you have to read in the evening or at night time, my personal favorite light source for reading tasks is a low-voltage incandescent halogen lamp, which is operated on a DC transformer. Direct current will eliminate all the dirty electricity and it will eliminate all the flicker. There are transformers available where you can adjust the output between 6 volts and 12 volts. As long as it's direct current, there is no flicker, there is no dirty electricity, and you are able to dim the halogen lamp into a color temperature which is comparable to candle light even. This is the softest, the healthiest electric light you can get at the moment. No LED will ever be so energy efficient, because you were talking several times about the energy efficiency.

If we extend the spectral range to the non-visible part of the near-infrared radiation – let's say if you would calculate the energy efficiency from 400 nanometers to a 1,400 nanometers, then the light source with the highest energy efficiency, would you like to make an educated guess?

JM: Probably the shorter wavelengths, I would think.

AW: The light source with the highest efficiency in the range from 400 nanometers to 1,400 nanometers would be —

JM: Would be incandescent.

AW: Halogen incandescent lamp.

JM: Yeah. Many people – I didn't know this either until you explained it to me that halogen is an incandescent lamp. It's an analog thermal light source. It's not digital.

AW: Yes. It is up to 100 percent more energy efficient compared to the standard incandescent lamp, so you have better energy use. You have less energy waste. And if you take into account the near-infrared radiation, and if you decide for your eyes, for example, for light hygiene for your retina, that you want to have these long wavelengths. In addition to the visible part, then the halogen, the low voltage halogen lamp, is the best and it reaches 4,000, 5,000 and in a dim stage, even 10,000 hours of lamp life.

JM: Is that on halogen – the AC halogen, or only with DC?

AW: It is only with DC because the AC halogen – No. We only can talk about high voltage and low voltage. Because you can operate the incandescent lamp – the incandescent lamp can be operated on AC as well as on DC. But if you operate the low-voltage incandescent lamp on DC, you have zero dirty electricity. If you operate it on AC, you have 20 times more dirty electricity compared to the AC high-voltage one.

JM: Okay.

AW: It's a little bit complicated. It's physicists' stuff. But AC, alternating current, always produces dirty electricity. And in the low-voltage ones, you need much more amperage. It's the currents and the other factor in —

JM: The resistance?

AW: No. The resistance, the current, the volt, and the ampere.

JM: Okay.

AW: So and the ampere value raises at a factor of 10 if you are working with AC on low-voltage. The best is low-voltage halogen lamps with DC, because those are ones which reach 5,000 and even more hours of lamp life.

JM: Okay. That gives us a pretty broad picture of some practical information we can now use to light ourselves at night. I mean, ideally. This is why our ancestors were so much healthier. Not only did they have more access to better food typically, they weren't processed or commercialized, they had better biological healthy analog light sources that were thermally based, not digitally based. That would be the best. Now, the other danger that most of us are exposed to pretty much every waking hour is our devices. Our computer screens, our tablets, our phones. They're almost all LED based and there's a lot of components here – and our e-readers too.

[-----1:00:00-----]

I use an e-book reader on the beach. It's called Kindle, the e-ink reader. Although it has an LED backlight that you can use at night, you can turn it all the way off and just look at the sunlight, which is reflected. I think that's really the ideal type of computer monitor that you could use. They are made -- I'm in the process of trying to find one. But in the meantime, I just recently purchased a notebook that has an organic light-emitting diode (OLED) screen and not an LED monitor.

It's really interesting because I'm a firm believer that you should use f.lux on your monitor not just at night. The default setting for that is to just come on at sunset, and yes that's helpful. It's probably the time that it's most important. But I keep it on all the time. There's no way I'm going to expose myself to that type of bright intensity light. But even though I can change a color temperature, it still has this digital pulse faking out my biology.

I want you to talk about the difference between OLED, LED, e-ink, f.lux, and also if we are outside and we have this LED or OLED screen and we've got the f.lux on, what I find personally is that I don't need to keep it all down at 2,700 degrees. I can essentially deactivate f.lux and put it up to 6,500 degrees if I need more light because you got all this light coming in. It sort of drowns out that monitor. I'm wondering if that's biologically healthy. A lot of stuff at you but these are really important questions.

AW: Talking about our digital screens, I prefer personally to reduce the color temperature, the correlated color temperature, also during the daytime for my notebook. As you already said, the e-ink would be a perfect solution because in this case, you can exactly control the quality of the incident light. By that, you control the quality of the light which will be reflected by the e-ink display. The problem is for motion pictures. It's just too slow. It's good for reading tasks but it's not good for watching videos or so.

The f.lux is one option you have. It depends a bit on the quality of your screen and the settings you are using if it really comparable to effective extinction of the blue light component, and what you could achieve with screen blue light protection glasses. Because they allow to eliminate the short wavelengths even better. The OLEDs technology, I'm not sure if the color is really stable in every angle you can look at the display.

But definitely, if you have the screen technology where black is really black, then you have less radiation coming into your eyes and the OLEDs technology is able to provide this. So the high contrasts between the black and white, all the black areas in the Thin-film-transistor (TFT) screen or the standard screen are not really black. They are also emitting radiation, also emitting shortwave radiation. The OLED screen only emits where you see light, where there is black on the screen, there is no light. This might be preferable as long as you have no problems with the looking angle.

JM: It's magnificent. I really love my new notebook. What I've noticed – I've compared the notebook side by side in the same settings outside and I put f.lux on both at 2,700 degrees Kelvin, which is an advanced setting that you have to go. It's in the upper right hand corner. It only goes down to 3,500 normally, which is the color temperature of halogen. You have to go to 2,700 and do it in advanced setting. But when you do that, Dr. Wunsch, it's amazing. The OLED is actually the same color you would see when you put on the blue blockers. And then the LED conventional notebook is like, you can tell it's like a blue light. You can see it night as day when you compare it. It looks orange when you have it by itself, but when you compare it with an OLED, there's a dramatic difference.

I'm also wondering, do you minimize the digital impact on the cell biology that you were referring to earlier with the OLED versions and LED?

AW: This depends again on the technology of dimming. I bet that you can get OLEDs displays with the pulse-width modulation dimming technology and you can also get OLED screens with the improved dimming technology, where you have reduced flicker or even eliminated flicker activity. These are the factors you would have to look at, and this is not so easy. Normally, you would need a flicker meter when you purchase or when you buy your notebook, and you should check – this is a recommendation – you should check every electrical lighting appliance before you buy it and bring it into your home.

JM: You can get a flicker meter or can you use the slow-motion mode of your cellphone, the more advanced cellphones, to do that detection?

AW: I would say if you are able to compare your smartphone to the reading of a flicker meter, then you can get a kind of confirmation of how reliable your smartphone is in detecting flicker. But in the slow-mo mode, you normally should be able to find out if there is a significant flicker level in the light source present.

JM: Maybe you can give us some links where we can pick up these flicker meters. I imagine they're not terribly expensive.

AW: They are not terribly expensive. You can get flicker – not meters – flicker detectors, which are, in my understanding, are even better than the meters, because if you get a certain value, it tells nothing. But if you hear an awful buzz or an awful noise, this makes absolutely clear that your light source is flickering and distributing dirty photons.

JM: In one of our earlier discussions, you actually told me about one of that you invented, didn't you? Do you actually have that for sale?

AW: I built something I think 12 or 15 years ago, because I just wanted to know what's going on around me. I still manufacture this. But hopefully, there will be an improved version soon. I don't know when it will be ready, but I'm working on that.

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JM: Okay, good.

AW: I mean it's not around 100 dollars. It should be around 30 to 40 dollars or so.

JM: As I mentioned in the beginning, if it's not obvious by now, you are just a wealth of information in this area. We're definitely going to have you on multiple times to expand on this because there's so much information that people need to know to absolutely have a better understanding.

What I really love about some of your videos – we're going to have links to those videos, the English ones – is that you put this in a historical framework, which is just so magnificent because once you understand the historical framework, you can start to begin to develop a deeper appreciation of how we veered on this path toward literally sabotaging ourselves with what we think is useful technology. But it has these enormous downstream biological side effects that we're exposing ourselves to.

With knowledge, we can proactively prevent most of this. But I think, to summarize this, because we're just kind of wrapping up, we really need to limit our exposure to this blue light. And it's not, not, not just at night, it's all day long. That's why you want to avoid these exposures. It's really important that you do that. Get the incandescent lights at night, blue blockers. Remember, it's so simple. As soon as the sun sets, I don't think you disagree with this, you put on those blue blockers. Nothing beats it. Don't take them off unless there's an emergency or you have to read something really carefully. It's just that you're sabotaging yourself when you don't.

You're increasing your reactive oxygen species and your retina pigment epithelium. You're producing your production melatonin not only in your penial gland, but also in your retina and other tissues. It's just so critical, and we never even touched on the other hormonal components. That's a whole other interview. I think that's about all we have time for. But I want you to summarize things from your perspective and emphasize any points you'd like to.

AW: I think you just made a perfect summary of the most important aspects. One thing to probably add or emphasize again, it's not the blue light coming from the sun itself which we should be concerned about. It's the blue light, the singular HEV or high energy visual light, which comes from cold energy-efficient light sources. This is what causes the problem, not the blue light which comes together with longer wavelengths in a kind of natural cocktail. So the light surrogates from non-thermal light sources. These are problems and you have to be clever to avoid these Trojan horses. If you want to make it sure, stay with the candles, stay with the incandescents.

JM: Yeah. The Trojan horses are really pernicious. Let me just—as you were mentioning that, it reminded me of one important one that most people don't realize, and these are the people who need it most. These are people with impaired and damaged vision. They go to their optometrists, they go to their ophthalmologists, and what do they do? They dilate their eyes. They open them up so you have no control. And then what do they do next? They shine a high blue light spectrum LED with no balanced red or infrared right onto the back of the retina. Now couldn't that be a worse prescription for damaging the retina? And they are clueless.

I definitely want you to comment on that, but there is a solution. Don't worry. Don't get upset. Just have them shine that through one of those blue blocking glasses and it's less dangerous. Can you comment on that because a lot of people are exposing their retinas to these dangerous radiations from their eye-care professionals?

AW: Sometimes, if I want to see if the lens of the eye of the patient is affected from cataracts, the blue LED light for just a second or so is very helpful because you can see kind of fluorescent effects in the lens. For diagnose purposes, it might be helpful. But of course, when we look at the exposure times, I think the higher impact comes from these Trojan horses – how do you pronounce it?

JM: Trojan. Trojan.

AW. The Trojan horses we invited into our households and from the light sources we are looking into continuously on a permanent basis, like our displays, smart phones, tablets, and so.

JM: Yeah, the chronic exposure is bad but I would have thought because of the high intensity of the illumination and the fact that the iris is maximally dilated or constricted, and it is such an impact on the retina that there's acute exposure. It's kind of like looking at an arc welding light, which can cause blindness or just being up on a mountain at 15,000 feet and taking off your goggles and getting blind. I would imagine that that acute high intensity exposure would be highly dangerous and would be ameliorated quite significantly if they were just to filter it with a blue blocking sunglass.

AW: Yeah. To reduce the exposure to the lowest level, which is possible, is for sure the best strategy.

JM: Okay, alright. Thank you so much. I am sure this is going to help so many people because, again, age-related macular degeneration is a serious, serious issue. I'm telling you, I just hope and pray to God that we can spread this message far and wide. Share this video with every one of your friends and family because they need to know. Otherwise, we are going to have – We already have an epidemic of obesity. We have an epidemic of heart disease. Cancer. Alzheimer's. We're going to have an epidemic of blindness unless we can get ourselves away from these chronic unopposed blue digital light sources, especially at night.

You've got to spread this message far and wide if we want to prevent this blindness epidemic. Just like cigarettes, it's not going to happen tomorrow, next week, next month, or next year. It's this chronic exposure. We need decades of this exposure before we're going to see it. For most of us, it's less than 10 years that we've had this exposure. We're not going to see it for a while. But it doesn't diminish the danger and the damage any less. So please spread this message far and wide.

We are definitely having you back on again, Dr. Wunsch, because you've got so much incredible information to share and there's going to be a lot of questions on this too. Thank you so much.

AW: Thank you very much, Dr. Mercola.

[END]