The Dangers of LED Lights: Dr. Alexander Wunsch, Expert in Photobiology, Interviewed by Dr. Mercola (subtitles)

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Natural health expert and Mercola.com founder Dr. Joseph Mercola interviews Dr. Alexander Wunsch about the hidden dangers of light-emitting diode (LED) lighting:

SUMMARY OF The Dangers of LED Lights - Interview With Dr. Alexander Wunsch

- Natural light is vital for energy production in our body. Only a third of our body's energy comes from food, while two thirds comes from exposure to light. Natural light is used by our mitochondria to produce ATP. Whatever we weigh in pounds or kilograms, we produce that amount in ATP every day. We may be able to go without oxygen for about 4 to 8 minutes, a few days without water, and months without food, but **without ATP, we can last only 15 seconds**.
- The light emitted from an LED does not have the same quality as that from a natural light source. We are sabotaging ourselves with this technology, but it has enormous downstream biological side effects. We already have epidemics of obesity, heart disease, cancer, and Alzheimer's – chronic exposure to LEDs will cause an epidemic of blindness. Like tobacco, we won't see the consequences for decades. Our exposure to LEDs is very recent.
- LEDs produce blue light, which has the highest energy in the visible part of the spectrum and induces oxidative stress. Our organism is not adapted to LEDs because we don't experience this kind of light quality in nature. LEDs are harmful

to our mental, retinal and hormonal health. Artificial light levels at night have reached insane intensities.

- Blue light from LEDs increases reactive oxygen species in your retina, reducing your production of melatonin, not only in the pineal gland, but also in your retina and other tissues. Age-related macular degeneration is a very serious problem.
- 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. The wavelengths we need for tissue regeneration and repair are NOT present in an LED spectrum.
- Light in a wavelength range between 570 nm and 850 nanometres, near infrared, boosts energy production, especially in cells where the energy production is depleted. This natural radiation or photonic energy penetrates deeply into the tissue, at least an inch or more, and can even pass through clothing. 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. The near infrared radiation in sunlight is very present in incandescent lamplight as well.
- A cell that has a better energy supply is able to perform better: a liver cell with more ATP will be able to detoxify the body better, fibroblasts in the skin will be able to synthesize more collagen fibres and so on. Many signs of aging are really the consequence of hampered mitochondrial functioning.
- **SOLUTIONS**:
    - Limit your exposure to blue light, not just at night, but all day long. [When using a computer at any time and,] Once the sun goes down, wear blue light-blocking glasses. These don’t have to be expensive.
    - Switch to incandescent bulbs, especially at night. They should be clear, transparent bulbs, not coated with white to give a cool white light.
    - Do not toxify your home with too much light. The intensity of a candle is sufficient for orientation.
    - If you have to read at night, use a low-voltage incandescent halogen lamp operated on a DC transformer. This is the softest, healthiest electric light you can get. DC or direct current eliminates all dirty electricity and eliminates all flicker; AC causes 20 times as much dirty electricity. Transformers that allow the output to be adjusted between 6 volts and 12 volts are available. You can dim the halogen lamp to a colour temperature which is comparable to

candlelight. Halogen is an incandescent lamp that is up to 100% more energy efficient compared to a standard incandescent lamp. It's not digital; it's an analogue thermal light source. Low voltage halogen lamps are best and can provide between 4,000 and 10,000 hours of lamp life (maximum when dimmed).

- Some of the new OLED screens may be better than older technology because OLED only emits where you *see* light, but there may be problems depending on the angle at which you are looking at the screen. Whether they are less harmful or not also depends on the technology of dimming, because some OLED displays have harmful pulse-width-modulation dimming technology, while others have an improved dimming technology with less or no flicker.
- Warn family and friends of the dangers.

TRANSCRIPT

Dr. Alexander Wunsch: I call these LEDs Trojan horses because they appear so practical to us. They appear to have so many advantages. They save energy. They are solid state or 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.

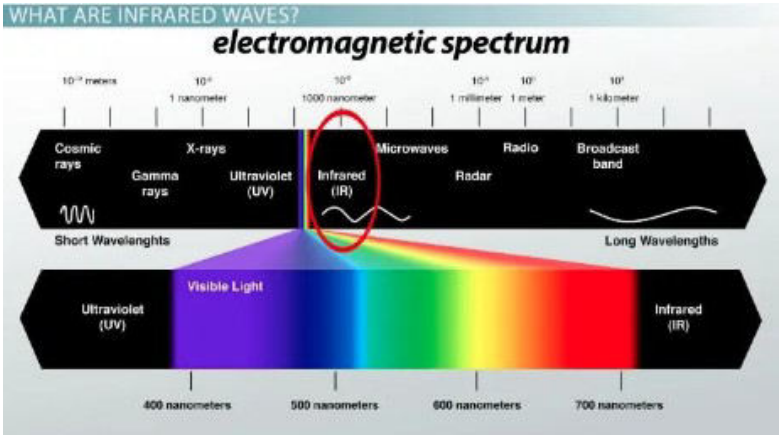
Dr. Mercola: This is one of the most important video interviews I believe you'll ever see. Hi. This is Dr. Mercola helping you take control of your health. And today we are joined by Dr. Alexander Wunsch from Germany. And he is really a world class expert, one of the best I know of, in photobiology.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

Dr. Alexander Wunsch: Hi, Dr. Mercola.

Dr. Mercola: 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, and what happens in the retina. The other light source I neglected to mention was infrared saunas. We can have a

discussion on that, too.

Dr. Alexander Wunsch: So the first question we have to ask is: “What molecules are we addressing?” or “What are the 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. And the first aspect is that we have to consider that there is a so-called optical tissue window, which ranges from 600 nanometres (nm) to 1,400 nanometres so it's almost completely covered by the infrared A part of the spectrum.



And this optical tissue window allows the radiation to penetrate deeply into the tissue. And when I say deeply, I'm not talking about a millimetre or two, I'm talking about several centimetres, or let's say, at least an inch or even more. And 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 are 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 a sheet, like a cover, the micro-anatomical structures within the cells. So, talking about the mitochondria first, here we have a specific molecule which is called “cytochrome C oxidase” [CcO]. And 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 phosphorylation of the energy production. [Protein phosphorylation often activates (or deactivates) many enzymes.] And this is the fuel our cells need for almost anything, for motility, for transporting of ions, for synthesizing products, for metabolism. So the ATP production, if it would stop right now, I could survive for another

12 or 15 seconds. So my body produces about 85 kilograms of ATP in 24 hours.

Dr. Mercola: Okay, let's stop there, because I've watched many of your videos in English. You have many more in German. And 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 people not appreciate what that is. But 85 kg, 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 that most people are clueless about. It's a really important concept. And the other thing you mentioned is that, yes, literally, we could last about 15 seconds without ATP, 15 seconds! Now we can go 4 minutes. Some people 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 an 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. So I'm sorry for interrupting you, but I just wanted to emphasize that.

Dr. Alexander Wunsch: It is 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. And here we have this tipping point where light, in a wavelength range between 570 nm and 850 nm, is able to boost the energy production, especially in cells where the energy production is depleted. So 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 depth regions and areas of the tissue. And 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. And there are many applications developed in the meantime where we use this optical tissue window and we shine light through this optical tissue window in a range which cannot be found in standard general lighting appliances like LEDs or fluorescent lamps. So the cytochrome C oxidase

is responsible for an increased production of ATP. And this means, in turn, that a cell which has a 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 fibroblasts in the skin will be able to synthesize more collagen fibres and so on. So this is one important brick in the wall.

Dr. Mercola: Maybe only one third, one third, a measly third of our energy that we produce and ultimately [inaudible] does with ATP, comes from the food that we eat, the electrons that are transferred from the food, primarily the fats and the carbohydrates that ultimately transferred to oxygen and generate that ATP. But only one third of the energy comes from ... The remaining two thirds or so comes from this light exposure. And if you're exposed to LED lights, as you just mentioned, but again, people, it may go over people's heads. The LEDs don't have that frequency from 500 to, I believe, 800 nm of wavelength, which is the near infrared primarily that hit the cytochrome C oxidase and generate the energy of the ATP. So can you expand on that? Because I think virtually no one has this appreciation.

Dr. Alexander Wunsch: 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. And 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 Kelvin. To keep up this body temperature is not only the result of burning carbohydrates in the mitochondria using the oxygen …

Dr. Mercola: Just for a moment. The 37 degrees Centigrade, or Celsius that you mentioned, is basically body temperature, which is 98.6 degrees Fahrenheit.

Dr. Alexander Wunsc: Okay, 98.6. So this I have to learn for the Americans.

Dr. Mercola: No, yeah, the Americans, dumb Americans, are still on the imperial measurement system for the most part, but the rest of the world is on Celsius.

Dr. Alexander Wunsch: So to maintain this body temperature is 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 lamplight 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 scanners and so on. And the radiation can enter the body and then will be transformed into longer wavelengths in the infrared part. And they are very important for supporting the temperature level, or the thermal energy level of our body, which is, for all the mammals, a very crucial aspect. So a lot of energy comes in the form of radiation, and this is supporting our thermal balance more or less. The light emitted from an LED does not have 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. And 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 the part of the blue light into longer wavelengths, yellowish light. And the yellowish light from the fluorescent layer combines, together with the residual blue light, to a kind of whitish light, which consists of a large portion of aggressive blue light. Blue has the highest energy in the visible part of the spectrum and causes or produces, induces the production of reactive oxygen species, of oxidative stress. So 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 wavelengths which are not present in an LED spectrum. So we have increased stress on the short wavelength part and we have reduced regeneration and repair on the long wavelength part. And this is the main problem: that the scissors come apart, in a way our organism is not accommodated to [adapted to] because we don't have this kind of light quality in nature.

Dr. Mercola: Are there … and many people have this question. You can get, I guess, cool white, which is the high blue light LEDs, which are bright white, versus the warm white LEDs. And I'm wondering 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. Or another version of this question: are there any healthy LEDs?

Dr. Alexander Wunsch: Well, there's no easy answer to that.

Dr. Mercola: (laughs) Like most good questions!

Dr. Alexander Wunsch: Because when you bought an incandescent lamp, you exactly knew everything about the spectral distribution, for example. You knew that, after 1,000 hours it would fail, it would break, stop functioning. In the LED world ...

Dr. Mercola: Let me interrupt you for a moment on this, because there's an interesting component, because everyone knows that the old incandescent bulbs fail at 1,000 hours. That, folks, is by design. There's a movie out, a documentary that talks about planned obsolescence. These bulbs could last a hundred years continuously if they designed it that way! It's designed to fail at a thousand hours. So I'm sorry for interrupting, but I just thought it was an interesting tangent.

Dr. Alexander Wunsch: 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 a lower portion in the blue, which are very close to the spectral distribution of an incandescent lamp with regard to the bluish part of the spectrum. It is impossible to tell without measurement. And this is the problem. With an incandescent lamp, you knew what you would get, and with an 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.

Dr. Mercola: 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 windows is two different animals. But if you have that as a component, it's not as biologically dangerous because, I believe that that compensates, especially with the higher frequencies in the sunlight, but it becomes really dangerous at night. So from the perspective – I haven't changed out all 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 and that would be crazy. I mean, there's just an 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 ... This is the take-home message of this presentation: you've 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 the white to give a cool white light because that's going to … you don't want that. You want the 2,700 degree Kelvin incandescent thermal analogue energy source of that light. That's the only light to use at night. Personally, that's the only light source I use after sunset. Even then, once the sun goes down, I put on my blue blockers – and I neglected to keep them here now because it's the middle of the day. I would put them on. But I call them reverse sunglasses. I don't care what company you get them, get whatever you can, you can get them at under $10. You can spend $100 for them, get whatever you like. But the moment the sun goes down, these blue blockers go on. And even if there's incandescent sources. So that's *my* summary, and I'm wondering if you could expand and really amplify those comments.

Dr. Alexander Wunsch: Yeah, 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 intensities. So the intensity of a candle, for example, is absolutely sufficient for orientation. And if you have to read in the evening or probably even at nighttime, my personal favourite light source for reading tasks is a low-voltage incandescent halogen lamp, which is operated on a DC transformer. So direct current will eliminate all the dirty electricity and it will eliminate all the flicker. And there are, for example, transformers available where you can adjust the output between 6 volts and 12 volts. And 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 to a colour temperature which is comparable to candlelight. So this is the softest, the healthiest electric light you can get at the moment. The light source with the highest energy efficiency in a range from 400 nm to 1,400 nm …

Dr. Mercola: ... would be incandescent?

Dr. Alexander Wunsch: … is halogen.

Dr. Mercola: Halogen, yeah.

Dr. Alexander Wunsch: Halogen incandescent lamp.

Dr. Mercola: I didn't know this either until you explained it to me that halogen is an incandescent lamp. It's an analogue thermal light source, it's not digital.

Dr. Alexander Wunsch: Yes, and it is up to 100% 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 low voltage halogen lamp is the best. And it reaches 4,000, 5,000 and in a dimmed state, even 10,000 hours of lamp life.

Dr. Mercola: Is that the AC halogen or only with DC?

Dr. Alexander Wunsch: It is only with DC because the AC halogen ... No, we only can talk about high voltage and low voltage.

Dr. Mercola. Okay.

Dr. Alexander Wunsch: … because 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 [correction: DC?] high voltage one, for example. Okay, so 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. So it's the current, and the other factor …

Dr. Mercola: Resistance?

Dr. Alexander Wunsch: No. Resistance, current and the volt, and the ampere.

Dr. Mercola: Okay.

Dr. Alexander Wunsch: And the ampere value rises by a factor of 10 if you are working

with AC on low voltage. So the best is low voltage halogen lamps with DC because those are the ones which reach up to 5,000 and even more hours of lamp life.

Dr. Mercola: Okay, so 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 access to better food, typically that wasn't processed and commercialized, but they had better biological, healthy analogue light sources that were thermally based, not digitally based. So 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. So they're almost all LED-based, and there's a lot of components here. So I use an e-book reader on the beach. It's Kindle, the ink reader. And even though it has an LED backlight that you could use at night, you can turn it all the way off and just look at sunlight, which is reflected. And I think that's really the ideal type of computer monitor to use. They aren't many – I'm in the process now of trying to find one. But in the meantime, I just recently purchased a notebook that's an OLED screen, O-L-E-D [organic light-emitting diode], and not an LED monitor. So it's really interesting because I'm a firm believer that you should use f.lux on your monitor, not just at night. And the default setting for that is just to come on at sunset. And yes, that's helpful. It's probably the time it's most important, but I keep it on all the time. There's no way I want to expose myself to that type of bright intensity light. But even though I can change the colour temperature, it still is this digital pulse faking [?] out my biology. So I want you to talk about the difference between OLED, LEDs, E-ink and f.lux. And also, if we are outside and we have the 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 the way down to 2,700 degrees. I can essentially deactivate f.lux and put it up to 6,500 degrees if I need more light, because I got all this light coming in that sort of drowns out that monitor. And I wonder if that's biologically healthy. So a lot of stuff at you, but it's important questions.

Dr. Alexander Wunsch: Talking about our digital screens, I prefer personally to reduce the colour temperature, the correlated colour temperature, also during the daytime for my notebook. And 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 [light that hits a surface]. And by that, you control the quality of the light which will be reflected by the E-ink display. The problem is that for motion pictures, it's just too slow. It's good for reading tasks, but it's not

good for watching videos and só on. The f.lux is one option you have. It depends a bit on the quality of your screen, and on the settings you are using. If it's really comparable with regard to effective extinction of the blue light component to what you could achieve with screen blue light protection glasses, because they allow to eliminate the short wavelengths even better. The OLED technology: I'm not sure if the colour is really stable in every angle [at which] you can look at the display. But definitely if you have a screen technology where black is really black, then you have less radiation coming to your eyes. And the OLED technology is able to provide this. So the high contrast between black and white. So all the black areas in a TFT screen, in a standard screen, are not really black. They are also emitting radiation, also emitting shortwave radiation. And the OLED screen only emits where you *see* light. And where there is black on the screen, there is no light. So this might be preferable as long as you have no problems with the looking angle.

Dr. Mercola: Yeah, it's magnificent. I really love my new notebook and, what I've noticed, I compare the notebooks side by side at the same settings outside, and I'll 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 doesn't only goes down to 3,500 normally, which is the colour temperature of halogen, so you have to go to 2,700 and do it in advanced setting. But once you do that, Dr. Wunsch, it's amazing. The OLED is actually the same colour you would see with putting on the blue blockers. And the LED, conventional notebook is – you can tell it's 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 to an OLED, there's a dramatic difference. And I'm also wondering, do you minimize the digital impact on the cell biology that you were referring to earlier with an OLED versus an LED?

Dr. Alexander Wunsch: Well, this depends again on the technology of dimming, because I bet that you can get OLED displays with pulse-width-modulation dimming technology, and you can also get OLED screens with an improved dimming technology, where you have reduced flicker or even eliminated flicker activity. So these are the factors you would have to look at.

Dr. Mercola: As I mentioned at the beginning – and if it's not obvious by now – you are just a wealth of information in this area. And 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 of it. And what I really love about some of your vídeos – and we're going to have links to those vídeos, of 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 develop a deeper appreciation of how we've veered on this path towards literally sabotaging ourselves with what we think is useful technology, but it has this enormous downstream biological side effects that we're exposing ourselves to. With knowledge, we can proactively prevent most of this. But I think that – to summarize this – because where time is kind of wrapping up – we really need to limit our exposure to this blue light. And it's not just at night, it's all day long. So that's why you want to avoid these exposures. It's really important that you do that. And get the incandescent lights at night. Blue blockers, remember? It's so simple. As soon as sunset – I don't think you disagree with this – you put on those blue blockers. Nothing beats it. Don't take them off. For whatever reason it is, it's an emergency – you have to read something really carefully. But I mean, it's just you're sabotaging yourself when you don't. And you're increasing your reactive oxygen species in your retina, your retinal pigmented epithelium, reducing your production of melatonin, not only in the pineal gland, but also in your retina and other tissues. So it's just so critical. And we never even touched on the other hormonal components. That's a whole other interview. I'm sure this is going to help so many people because, again, age-related macular degeneration is a serious, serious issue. And 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 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. So 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, next year. It's this chronic exposure. We need decades of this exposure before we're going to see it. And 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 or the damage any less. So please share this message far and wide. And 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. So thanks so much.

Dr. Mercola: Thank you very much, Dr. Mercola.

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