Healing the Body With Photobiomodulation:  
A Special Interview With Dr. Michael Hamblin

By Dr. Joseph Mercola

JM: Dr. Joseph Mercola  
MH: Dr. Michael Hamblin

JM: Infrared light: an important therapy you likely don’t know enough about. Hi, this is Dr. Mercola, helping you take control of your health. Today we are joined by Dr. Michael Hamblin, who is an expert in this area. He has quite a prestigious background of credentials as a researcher. He’s an associate professor of dermatology at Harvard Medical School. He’s also a principal investigator at The Wellman Center for Photomedicine at Massachusetts General Hospital, and a member of the Harvard-MIT Division of Health Sciences and Technology. He’s really got an enormous amount of expertise in this area. We are honored and really privileged to have him with us today. Thank you for joining us, Dr. Hamblin.

MH: I’m pleased to be joining you, Dr. Mercola. Do you want me to just plow right in, or would you like to ask some questions?

JM: I have a load of questions because I’m absolutely beyond fascinated with this topic. Because I think the implications are just extraordinary with respect to what it can do for our health. [It’s] relatively inexpensive and certainly almost always non-toxic. Those are high on my list of great characteristics of strategies I’d like to recommend. Why don’t you start and then I’ll interject my questions as you go along?

MH: Okay. You started off introducing a concept you called infrared therapy. That is part of a thing that we call photobiomodulation. Photobiomodulation now includes lights of all wavelengths – visible light, light from the blues, through the green, through the red, and into the infrared. Possibly, the most commonly used wavelengths of light are what we call the near-infrared. That starts [at] about 750 nanometers and goes all the way into maybe 1,200 nanometers. That’s the near-infrared, which has a lot of biological effects. It also penetrates well into the body, because other colors of light, like blue and green, have a lot of biological effects, but they don’t penetrate too well.

Ideally, we want to have highly active wavelengths of light that penetrate well into the body. There is another kind of infrared radiation usually called far-infrared, which, again, has biological effects. That’s the kind of infrared that you get from an infrared heat lamp or an infrared sauna. A lot of people like infrared saunas. They have a lot of health benefits. They’re sort of vaguely similar to photobiomodulation, but there are differences.

JM: Let’s stop here for a moment just to clear up some of these distinctions because my understanding of heat lamps is that they are indeed mostly far-infrared, but 10 percent of the energy is near-infrared.

MH: I agree. Yup.
**JM:** They do have important biological effects also. With respect to the penetration, it’s my understanding that those higher wavelengths beyond 900 to 1,000 nanometers tend not to penetrate well. They do penetrate, but the problem is that the water, which is a magnificent chromophore, absorbs them before they get to the tissues. Can you expand on that?

**MH:** Absolutely. You’re quite right that after a certain wavelength, the principle biological chromophore is water. It’s quite clear that far-infrared is absorbed by water. Some near-infrared wavelengths are better absorbed by water. You may ask how is the energy that’s just absorbed by plain old water, how can it do anything with great biological consequence?

**JM:** Good question.

**MH:** The answer is that this is [a] concept called nanostructured water. This has been principally discussed by physicists and material scientists, but it turns out that nanostructured water is present on hydrophobic surfaces, like certain kinds of cell membranes. It could be inside the cell in various organelles.

**JM:** Excuse me for interrupting, but this would be inside the mitochondria, too. It would also be in the extracellular space?

**MH:** In the plasma membrane, the mitochondrial membrane and the endoplasmic reticulum (ER) membrane. Virtually all membranes in principle can have nanostructured water. Some people say the mitochondria are basically full of nanostructured water. I have heard that. The idea is that a small amount of vibrational energy in the water molecules can perturb tertiary protein structure, which is particularly important. The things like ion channels.

As you know, ion channels have a huge number of biological pathways. There’s no real bulk heating when you use far-infrared, the sort of levels that get into the tissue. It may heat up the skin a bit, but at depth, it can have biological effects by altering protein structure, mediated by nanostructured water without being able to measure any bulk temperature change.

**JM:** Okay. This mechanism of action differs from the near-infrared, which seems to focus on the cytochrome c oxidase in the mitochondria primarily, improving or increasing the production of adenosine triphosphate (ATP), but also releasing nitric oxide, which has important signaling effects. It would be great if you could expand on that.

**MH:** Okay. I think you’re absolutely right that the accepted mechanism in the mitochondria involves dissociation of nitric oxide from cytochrome c oxidase, increasing electron transport and ATP synthesis.

Now, people measure nitric oxide release. It’s not clear that all the nitric oxide comes from dissociation of cytochrome c oxidase. The reason for that is – I actually just mentioned a little while ago – ion channels. Turns out that a lot of these what we call transient receptor potential ion channels will activate various kinds of nitric oxide synthase or nitrate reductase. There are
several recognized pathways to nitric oxide, other than dissociation from [inaudible 06:42] coefficients and cytochrome c oxidase.

Interestingly, the kind of light that produces these other nitric oxide pathways tend to be out of the blue or green, quite a long wavelength near-infrared. That’s what we found in our labs. The red and short near-infrared produce nitric oxide probably by a different pathway from blue, green and long near-infrared. That’s our present understanding of this.

JM: Any speculation what those pathways might be? Because I haven’t read about that in the literature.

MH: Well, that’s to say these nitric oxide synthase and nitrate reductase have been shown to be activated by ion channels, by transient receptor potential cation channel (TRPA1).

JM: Alright.

MH: Yeah. Somebody also showed that cytochrome c oxidase could be a light-dependent nitrite reductase, which is different from dissociating [inaudible 07:47] nitric oxide. There’s a lot of proofs to learn about the mechanisms. I think we’re making substantial progress in teasing apart these mechanisms. It keeps folks like me busy in the lab. By and large, the thing to remember about photobiomodulation is it’s highly biphasic in dose. Many people have got themselves into trouble by giving too much light.

JM: I definitely want to touch on that. Please expound because this is a massively important concept. It’s the Goldilocks dose. There’s this narrow range where it’s going to give you benefit. Below that, not much benefit, and above, you can actually cause harm.

MH: That’s the idea. Yes. It’s not a narrow range, actually. It’s quite a wide range. Obviously, there’s a power density that we call milliwatts per square centimeter. There is a level where nothing will happen. You can sit in this light 24 hours a day, and it will have no effect. That’s very low levels of light. Then you raise the dose and you get biological effects. If you keep raising it, these effects will diminish. It’s possible that if you give a huge amount of light, you could actually damage the tissue.

People have even proposed you could treat cancer, for instance, by giving huge amounts of light. Not the most efficient way, but people have proposed it. By and large, somewhere between 10- and 20-fold is a positive window. You could give 2 milliwatts per square centimeter. That would be fine. You could give 30 milliwatts per square centimeter, that would probably also be fine. The best thing is somewhere in the middle. It’s not like [it’s] balanced on a knife edge.

[-----10:00-----]

JM: The ideal dose is about 10 milliwatts per square centimeter?

MH: That’s the power density. The dose is usually calculated in joules per square centimeter.

JM: Okay.
MH: When you have 10 milliwatts per square centimeter, that is 1 joule every 100 seconds, which is 1 and two-thirds minutes. If you want 10 joules, 10 joules is a reasonable sort of dose. If you’re treating things deeper in the body, you may want more than 10 joules per square centimeters. You may want 20 or 30. One hundred’s probably too much. Also, it takes a long time. You’re going to have a very powerful light source.

Another thing to remember that confuses people a lot is a lot of people have lasers. The lasers have little spots, little focus spots. They say, “Okay. I’ve got a 10-milliwatt laser, but my spot area is only 1 square millimeter. My power density from a 10-milliwatt laser is 1 watt per square centimeter. In my opinion, this is complete nonsense. If you have a 10-milliwatt laser, the most power you could deliver is 10 milliwatts. It doesn’t matter too much what the size of the spot is because the photons start to scatter as soon as they go into the tissue. The spot gets big, gets huge. Having a tiny little focus spot from a low-power laser, in my opinion, just confuses people.

JM: Just for clarification, the laser is coherent light.

MH: It is.

JM: Most of the original research was done with lasers. But there’s this massive trend in the research now. Your great example of that is towards using light emitting diodes (LEDs), which are more cost-effective. It seems to be more of an effective and efficient way to provide the therapy.

MH: I completely agree. The only convincing case where you really want a laser is if you want to get the light into an optical fiber because you want to put it inside the body, if you want to have an endoscope or put the light in the lungs or the stomach. A lot of people do this occasionally. You pretty much need a laser to focus the light into an optical fiber. It’s kind of difficult to do it with LEDs.

JM: Sure. That’s for diagnostic purposes, certainly not for therapy.

MH: All people do it. The Russians used to do a lot of therapy with internal optical fibers in the heart, in the blood vessels. It’s not so common in the West, I have to say.

JM: I haven’t heard of it before, but certainly for diagnostics with endoscopes and such.

MH: Yeah. Absolutely, absolutely. The one trend in this field with LEDs is to have flexible LED arrays that are wearable, right? These are like things you can wrap around your joints or a hat you can put on your head or something you can put on your back for lower back pain. I think a lot of companies are coming out with these flexible LED wearable devices. I think it’s a big growth field.

JM: Just for clarification, the LED isn’t flexible, but the frame that is attached to it is, so that it can mold to the contours of your body.
MH: I just want to point out that now they have organic LEDs, OLEDs, where the actual light emitting substance is flexible.

JM: Wow.

MH: That’s coming in.

JM: Yes. Certainly it’s available for TVs and for many of our phones and devices. But I wasn’t aware that they actually had them therapeutically.

MH: People are kind of studying it. I don’t think you can buy one yet, but there are a few folks trying to do it.

JM: They have them in the infrared OLEDs?

MH: I believe.

JM: Interesting.

MH: But they are more common in the red.

JM: WOW.

MH: It’s tricky to make them in the near-infrared.

JM: Okay, great. Thank you for that fundamental primer on the photobiomodulation. I just want to give a little basic intro to the next section. It wasn’t really stated but I want to make it clear that most of us eat food for fuel. This fuel is converted to basically fats and glucose and it really generates ATP. But a big section of that ATP generation that you alluded to is really this exposure to the near-infrared, which powers the mitochondria to produce additional ATP so it’s both.

If you’re only existing in a cave without any near-infrared light exposure, you’re really depriving yourself of the very valuable food source. Why don’t we expand on that a bit and then we’ll talk about the different available ways that one can nourish your body with that type of exposure?

MH: I would sort of say that you can’t say that light is a food. What light does is it allows you to use your food much more efficiently. You couldn’t live on light for instance.

JM: No.

MH: But the light does help the cells make the best use of the food they’ve got [and] the better production of energy. For instance, in the Western world, people are getting obese and nobody exercises, light does seem to combine very well with modest amounts of exercise.
You could lose weight, your muscles perform way better, and it has a huge amount of health benefits, things like diabetes and blood lipids. Even psychological health is benefitted by exercise combined with light.

**JM:** Yeah. The sad reality for most of us who exercise is that we are doing it in environments where we’re exposed to artificial blue light primarily through cool white LEDs and fluorescent lamps that have very little red and near-infrared, virtually no near-infrared. That is a definite problem. That’s not going to nourish your health. Ideally, you would want to exercise outside in full-sunlight. Maybe you can comment on that.

**MH:** Blue light is good in the morning. That’s quite clear that exposing yourself to blue bright light in the morning balances a lot of brain circuits.

**JM:** I agree with that, but if it just had blue light exclusively where you’re creating this reactive oxygen species (ROS) specifically in the retina to help optimize the production of melatonin and you don’t balance that damage with the near-infrared regenerative restore mechanism, then you have problems. That’s what I was referring to, this artificial exposure to LED light and fluorescent that doesn’t have the red and the near-infrared.

**MH:** I think it’s highly dependent on the time of day. Red near-infrared light at night produces melatonin, helps you sleep. Blue bright light in the morning kind of balances your brain circuits. It’s anti-depressant. It kind of gives you more alertness. As with anything, dose is key. You can probably more easily overdose yourself with blue light than probably any other wavelength. I think you have to be careful with blue light because you can probably overdo it.

**JM:** Excellent. It would appear, just superficially, that the ideal way to receive most of this exposure, and certainly the least expensive for most of us, would be to simply go outside and expose as much of your skin as possible. Obviously impractical for most people in the winter, unless you live in the subtropics, but certainly for the summer, that’s possible.

I’m wondering if you could help us understand the comparative therapy benefits or therapeutic benefits from sunlight exposure versus some of these devices that generate the red and the near-infrared. It has to do with the energy density. That’s something I don’t quite understand. I’m hoping that you can help us, or at least me, clear up the confusion. I suspect many others would too.

**MH:** Eighty or 90 years ago in Europe, there was a big thing about heliotherapy clinics. Patients who had all sorts of chronic conditions would go to clinics in the Alps where they would expose themselves to sunlight. Oskar Bernhardt was one of the German guys that started this whole thing. He once said that you need to be in the mountains. He said if you just go and lie in the sun on the beach, all you’re getting is a sunbath. But if you go up in the mountains, you’re actually getting a medical therapy.

The key question is why is sunlight so much better up in the mountains? One theory was that it’s got a lot more ultraviolet if you go up high, but that’s probably not the reason, in my opinion. Ultraviolet will give you sunburn if you get too much of it. I don’t think it’s the ultraviolet.
think that in high altitudes, there’s much less oxygen in the atmosphere and the mitochondria are working at a different kind of cycle, right? The oxidative phosphorelation is more skewed towards glycolysis because the oxygen availability is less at high altitudes. That’s just my pet theory. But people used to get complete chronic wounds healed by going to these heliotherapy clinics, just the same as you would do at sea level with our near-infrared LED array.

[----20:00-----]

I think people like sunlight. Everybody likes sunlight. Provided that you take precautions against getting too much ultraviolet, I think sunlight’s fine. But you know, we have busy lives and since you can get a therapeutic dose of near-infrared from an LED array for maybe 10 minutes a day, I think that’s probably the way to go.

**JM:** Okay. But are you suggesting that you can receive equivalent benefits from either? If you have the opportunity to expose yourself outside, either in the subtropics in the winter or, as you’ve mentioned, in altitude, because I’ve got friends who live at Park City, which is like 7,000 or 8,000 feet. Even in February, they’re actually getting enough ultraviolet B radiation when it’s warm. Because when it’s sunny in the afternoon, they can expose themselves and their skin and actually get significant levels of vitamin D even in February.

**MH:** The vitamin D is obviously another great plus about sunlight. Again, you can get too much UV. Everybody needs enough ultraviolet (UV) to get a [inaudible 21:27] vitamin D. I just thought it was interesting this thing from 80 years ago, about the altitude because I don’t think anybody ever tweaked this.

Another interesting thing that I thought once was that throughout human history, people have liked to sit around fires. Tens of thousands of years from cavemen, every evening people would sit around a fire and expose themselves to infrared, a lot of it far infrared. That’s the sort of thing you get from glowing embers. It’s only in the last 30 years that people have stopped sitting around fires regularly. Everybody has central heating now. You could say that Western civilization is suffering from a deficit of far infrared light.

**JM:** Yes, indeed. Yes, indeed. As you mentioned for that timeframe, that was really the only light exposure we had at night. It was literally some type of fire, whether it was a lamp, or a regular wood fire, or a stove, or a candle. That was it in the last 150 years or so or 225 that we’ve had these artificial lights. Fortunately, the first ones, the incandescents, were relatively close to those fires. They had a little more blue of course, but not much more. If you look at the spectrum, it’s pretty close to a candle.

**MH:** Absolutely.

**JM:** But that’s not the case now. We’ve progressed to the fluorescents and the LEDs, which are massively more energy efficient, but biologically not as healthy.

**MH:** Yeah. I think a lot of people think that regular fluorescent lights, like most of us have in our offices, are probably bad for you. By and large, certainly not good for you, possibly slightly bad. I think the thing about LEDs is that generally you put them right next to your skin, relatively
we feel it, 10 minutes, 20 minutes, that sort of period. You can feel the benefit. Not all energy is seen.

There’s a whole body light bed – James Carroll makes this – called NovoTHOR. It’s an amazing thing. It’s 500 watts of LED power.

**JM:** Okay.

**MH:** You can lie in it for like 10 minutes. You can feel the difference. You really can. It’s kind of expensive. Not many people have one at home.

**JM:** What’s the price range on something like that?

**MH:** Over 100,000 dollars.

**JM:** That is quite expensive. Yes. What type of LEDs do they have in there? Certainly the red and near-infrared.

**MH:** It’s 660, 850, I think.

**JM:** That’s it? That’s the only two?

**MH:** Only two. Yeah.

**JM:** Wow.

**MH:** It’s probably equal, maybe a bit more of the near-infrared. A lot of people put one part of red and two parts of near-infrared.

**JM:** Let me ask you sort of a tweaking question because it seems we never really addressed the optimized wavelength for stimulating cytochrome c oxidase. There seems to be a range of about 810 to 830. You just mentioned 850. What would your guess be? Your studies show that that is the ideal target. When you answer that we’ll talk about other components, too. I think that that is a very narrow focus stream. I want to compare that to the analog exposure that you get from something like sunlight.

**MH:** We’ve done a lot of studies over the years. We cannot really detect a difference between red light, like 660, and near-infrared, let us say 810, 830 and 850. First of all, all the 800s seem to be the same. Also something in the mid-600s, like 660, is the same as the near-infrared. A few other folks have claimed to find some differences, but there’s not much difference really.

**JM:** Really? So the red at 660 will still provide the same mitochondrial benefits?

**MH:** Yup. Absolutely.

**JM:** I did not know that.
MH: Uh-huh.

JM: That is interesting. I thought they were completely different. But it makes sense because they were pretty close. I mean they’re not that far apart.

MH: No. But in between, 730 does virtually nothing.

JM: Interesting. Why do you think that is?

MH: The theory is the absorption spectrum of cytochrome c oxidase has two peaks: one in the mid-600s and one at around 800.

JM: Okay.

MH: Tiina Karu published that. Wisconsin folks published that. Several folks have done that.

JM: Okay. Let’s transition into the difference between the focused digital spectrum of an LED light source and an analog, like an incandescent or the sun, which has the complete wavelengths. You just alluded to the fact that there are these bands or gaps that doesn’t appear to be any biological benefit, although I’m inclined or concerned that that may be the same approach that we looked at junk DNA previously, which we now know is not junk DNA, that actually has some benefit. We just don’t understand it at this point. Maybe you can expand on that, at least with the current thought on this concept is.

MH: I think that some wavelengths seem to be very good for relieving pain, blue light particularly. We probably know that Philips is selling out a blue LED patch called the BlueTouch for lower back pain. Other folks are starting to use blue light for painful conditions. People say red light is good for relieving inflammation, inflammatory conditions. I think near-infrared is good for regenerating things, possibly because things that need regenerating are usually deeper; tendons, bones, cartilage. Things that need regenerating are usually deeper inside. It’s quite clear that near-infrared penetrates better. Everybody agrees on that.

Obviously, one of the big growth areas is the brain. Again, this is really intriguing because folks find benefits in the brain by putting all sorts of light on the head; high power near-infrared, lasers, high power LEDs. But relatively, low powered devices that can go up the nose, they can go in the ears, you can go different parts of the head. Everybody thinks, “Well, photons are going to get in the brain. There’s going to be a certain power density.” But it’s not clear.

The photons can be absorbed in the blood. You have blood circulating in your scalp. You have bone marrow in the bone of your skull. It’s known that light is very good at activating stem cells in bone marrow. That’s one of the big deals. Clearly, photobiomodulation has huge effects on the brain. Still, the jury’s out on what is the best way to get light in your head.

JM: Well, you’re actually involved in a number of studies to answer that question. I know you’ve done some publishing work with Dr. Lew Lim.
MH: Lew Lim? Yup.

JM: Especially with respect to treating neurodegenerative diseases, like Alzheimer’s. Maybe you could summarize what you’ve learned to date.

MH: Yup. There have only been a few studies so far about photobiomodulation for Alzheimer’s, since Alzheimer’s is going to be the huge epidemic and it’s going to decimate health care costs and all this. In fact, most drug trials for Alzheimer’s have failed dismally, right? The cost of billions of dollars. A few folks with small trials for Alzheimer’s get results so good that nobody can believe them.

[-----30:00-----]

These are old folks who can never say a coherent sentence, and in weeks and months, suddenly kind of start talking with their relatives. People who have to be fed suddenly start using a knife and fork. I mean a lot of people just can’t believe it. We do have some statistics, only relatively small series of patients, but we do have statistical significance. In my opinion, the effects are so surprisingly good that this has to spread. It really has to spread. People have to do big trials and I would expect in five or 10 years that photobiomodulation for Alzheimer’s has to be pretty much out there.

JM: I think it’s an emerging therapeutic avenue. I’m really excited about the introduction of this because of the cost and the safety. But some of these devices are not 100,000 dollars, they’re not even 10,000.

MH: Absolutely.

JM: But to make it more affordable for virtually everyone, I’m wondering if you could comment on the use of a handheld infrared heat massager, like a 10-watt infrared heat lamp, that’s relatively small powered and could easily be applied over the scalp and the head. I wonder what your thoughts are on that for being able to provide the effective stimulation to the critical areas in the brain.

MH: I get a lot of emails from folks, asking me what device they can buy to use at home. A lot of these folks do not have a lot of money. I tell them to look for near-infrared security floodlights. These are 850 nanometers and they’re sold so that various companies can have an invisible security light with an infrared camera so intruders can’t see they’re being filmed. These are powerful. You can get 70 or 100 watts of optical power for 1,000 dollars, a few hundred dollars sometimes. If this was a laser, it would cost you 100,000 dollars. But these LEDs that are produced in the Far East and made into these flood lamps, each single diode is 3 watts, right? That is a chunky diode.

JM: Yes, it is. There are a lot of them. I’m wondering if we could go back and really address the Goldilocks dose, because you mentioned that there’s a fairly significant band of therapeutic efficacy, but at some point, it becomes actually counter-productive and actually causes more
harm than good. What do you think the window is with respect to the number of watts of these LEDs that you’d be putting on your scalp?

**MH:** Right. Again, this is a good question. It’s the total amount of energy you’re putting in your body, because these arrays – for instance, the whole body light bed is a huge area. The power density is modest. It’s the same as anybody would use; 10 or 20 milliwatts per square centimeter.

**JM:** That is the power density on that bed. Okay.

**MH:** Yeah. But it’s the big area. If I did all the LED arrays, it’s 10 or 20. A lot of these devices have the same power density because they’re big and there are a lot of diodes. You put more energy into the body. What we don’t really know is can you overdose the body on total joules or is it only when it’s concentrated? That’s what we don’t know. My gut feeling is that people are not going to stay under these things forever. Ten minutes or half an hour does no harm at all.

**JM:** Okay.

**MH:** Maybe if you went to sleep all night, you would overdose yourself. It wouldn’t surprise me. Mostly, I tell people they can use these things for 10 or 20 minutes a day and it’ll have major benefits and extremely unlikely to have any ill effects.

**JM:** Let me also just comment that these security lamps or devices that you recommended – thank you for that – because they’re 850 nanometers, that’s not a lot of heat. Whereas if you have the equivalent 100-watt heat lamp, you could burn yourself. But you’re not going to burn yourself with this.

**MH:** No. Virtually no heat at all. You can feel a little warmth but there’s like no heat there.

**JM:** Yeah. That’s a great strategy. Actually, it just occurred to me that this may be more effective to set because a number of people have infrared saunas. That has been a popular choice. I am a strong advocate of those. There are many benefits, as long as they are very low electromagnetic frequencies (EMF) because you can have very dangerous EMF because you can have very dangerous EMF from some of these ceramic panels. But I think if you have one of those low-EMF far-infrared, it would seem that you could put some of these security lamp devices in there. It really isn’t full-spectrum. But I guess biologically full spectrum, because you’re getting the near-infrared and you’re getting certainly all the far-infrared.

**MH:** I’ve heard that people are getting saunas that have both near-infrared and far-infrared. Trying to get the best of both worlds.

**JM:** I think that’s being done with heat lamps, which is good because you want to get hot anyway. But 80 to 90 percent of that heat lamp is still far-infrared. It’s not the near.

**MH:** Yup. Absolutely.
JM: It seems it would be a lot more effective dose if you used these security camera lights. Is that what they’re called?

MH: Floodlights. I think they call them near-infrared floodlights.

JM: Okay. That’s a great strategy. To the best of your knowledge, no one’s really doing experiments with these?

MH: No. I don’t think so. No.

JM: But the science suggests that it would work. The science has been done.

MH: Yeah. Several folks have got them because I recommended them. The feedback I get is they work just great.

JM: Wow. Work great for what?

MH: A lot of people have problems with the brain. But other people have like orthopedic problems, musculoskeletal problems, where typically, near-infrared photobiomodulation works great. The question just is what’s the best way to deliver it to the body?

JM: Yes, indeed.

MH: I think that a lot of applications that are going to be great, but nobody’s really studied that much. I’ll give you one example, which is kidney failure. Kidney failure is the third leading cause of death. These are old folks who are dying from kidney failure. You can’t really give them transplants because they’re elderly. You put a near-infrared LED array where their kidneys are and it seems to work like a dream. It’s hardly been studied at all.

JM: Oh my gosh. Before I went to medical school, I actually harvested kidneys for transplants for patients. I have some experience in that area. Even in ideal circumstances, it’s not your own tissue so you have to be placed on these very dangerous and necessary immunosuppressive drugs, which will literally seek to destroy your immune system or certainly suppress it and have their own complications. And the cost of that.

I believe it’s an aspect of Medicare or Medicate program. I think it’s Medicare end-stage renal disease program, where it’s covered by the government. They don’t have to worry about paying for it, but geez. It is expensive and we’re spending 3 trillion dollars a year every year. It would be a far less expensive and safer long-term option to use some infrared therapy.

MH: Absolutely. I couldn’t agree more.

JM: Yeah. Any other exciting applications that you’ve seen it used for? I wasn’t aware of the kidney one.
**MH:** Yeah. Diabetes, metabolic syndrome, diabetes. Where do you put the light? I think most people end up putting it on the belly, right? Because light has effects on fats and it can melt it away a little bit. It’s anti-inflammatory. A lot of these problems are caused by having excess inflammation in your belly fat, the big sort of reservoir of all these inflammatory cytokines.

**JM:** Could you explain the impact of near-infrared on the inflammatory process in the cytokines?

**MH:** It’s highly anti-inflammatory. It seems to change the macrophage phenotype from M1, which is pro-inflammatory, interleukin-1, TNF IL-6, to M2 phenotype, which is IL-4, IL-10, TGF-beta. The interesting thing is that M2 macrophages are really good at phagocytosis. They gobble up the garbage.

[-----40:00-----]

In your brain, when you’ve got amyloid plaques or tau tangles or alpha synuclein sort of aggregates, reducing the inflammation is key, but also encouraging the microglia to be good garbage removal agents, in my opinion, is hugely important. But nevertheless, for many systemic inflammatory disorders, such as type 2 diabetes and metabolic syndrome and all these things, changing inflammatory profile from pro-inflammatory to anti-inflammatory is a huge big deal.

**JM:** It sounds like there would be some benefit to expose yourself on a regular basis. I’ve seen some devices that are almost the size of a conventional door that have about 300 watts of LEDs.

**MH:** Okay.

**JM:** You can essentially expose your whole body to it. In a rate like that, what would be your estimate for an optimal dosing strategy? Like 10 minutes on each side of your body?

**MH:** Yup. In fact, that’s probably right. Absolutely. Yeah.

**JM:** It’s simple to do. At 600 and 850, is there any danger to looking at that light when you’re standing in front of the bed, from your perspective? It’s probably healthy and beneficial, I would think.

**MH:** Red light can dazzle you, especially at 630. If you look at a 630 nanometer rate, you get dazzled, but it’s not harmful for the eyes. It takes you a while to recover. Near-infrared is actually very good for your eyes, things like 830 or 850. As I get older, I know that my eyesight is not as good as it was. I quite often stick some 850 nanometer light in my eyes.

**JM:** Let’s talk about that for a minute because we do have an epidemic, not only of Alzheimer’s but of age-related macular degeneration. It’s my contention and belief that that’s largely related to the exposure of these tremendous amounts of LED light sources on our computer monitors, on our phones, our lights in our home and offices. Paying careful attention to that – and if you’re traveling at night.
When you’re traveling down the road, every one of those headlights, almost every one, I’m sure there’s some antique autos that have incandescents, but almost all the new cars have LED lamps. You’re staring into headlights that have LED, which is blue light, at night when you don’t need at all.

**MH:** I supposed headlights, driving at night is not good for you. I think the contribution to age-related macular degeneration of ambient light is probably minimal. I think it’s much more an unhealthy lifestyle with no antioxidants, too much fat, too much stress, not enough exercise, chronic and systemic inflammation, and all the things that are causing most of the diseases of the Western world. But there are papers that show that blue light can damage the retina.

**JM:** They’re pretty clear. I read a number of studies that support that, especially if it’s not balanced with the infrared. That’s why when I drive at night, I always have my yellow sunglasses in the car. I put my sunglasses on at night.

**MH:** Alright.

**JM:** I put them on so all the headlamps look yellow.

**MH:** That’s probably a good idea.

**JM:** Let me just share my personal experience, even though it’s anecdotal and certainly doesn’t prove a darn thing at all, but I’ve noticed an improvement in my visual acuity. I typically run all my monitors, it’s very rare where I put it over 2,000, unless I have to see something. Typically, especially in the early morning, that’s the 1,200 K, which is pretty much orange. It’s pretty interesting.

It doesn’t matter what I think. You’re the expert. I’m wondering what your perspective [is]. You’re the expert in the photobiomodulation. It seems from my perspective that if you could avoid this blue light at the wrong times and you can nourish your eye with these healing near-infrared frequencies, that you could actually reverse this macular degeneration. What’s your impression?

**MH:** There’s a startup company called LumiThera, which Clark Thedford started up, which is treating age-related macular degeneration with photobiomodulation. It’s a specific device, a bit like a slit lamp when you put it in your eyes, the right sort of slots. This machine shines light into your eyes, red and near-infrared principally. There are some clinical trials, but I don’t know whether they’re published yet. The odds are that it’s highly effective and it will eventually get Food and Drug Administration (FDA) approval and they will be able to market this device to ophthalmologists. That’s his business plan. It’s a clinical device for ophthalmologists.

**JM:** That’s great, but you’ve shared with us the bio hack work-around that you don’t have to wait for the FDA that you can buy today on Amazon with are 850 security camera infrared light.

**MH:** Absolutely.
JM: You can use it today. They’re essentially affirmed that there’s no danger at these frequencies, energy intensities rather.

MH: Absolutely. In the future, we envisioned some devices which will get FDA clearance for efficacy and will be clinically used in hospitals and [by] ophthalmologists, even psychiatrists and all medical professionals. Then there would be a whole army of other devices that people have at home. I can see the day when every household will have one or two light therapy devices.

JM: Absolutely. I would like you to comment now on the frequency because most of the devices that we’re referencing are continuous. There’s no frequency. There’s just a steady stream of photons coming out. You can modulate it with frequencies. It’s my understanding that the ideal’s probably between 10 and 40 hertz. Anything over 100 hertz probably doesn’t have any biological effect, or maybe a negative biological effect. I’m wondering if you can talk about how important it would be for the frequencies, and maybe even optimizing that security light by making it pulse at 10, 20 and 30 hertz.

MH: Yup. I think, by and large, I agree with you that if it turns out that pulsing is better than continuous wave (CW), and there is quite a bit of evidence, it probably is better. Maybe not a huge amount better, but definitely better. The optimum frequency is somewhere between 10, 20, 30 [and] 40 hertz. There was a study from Massachusetts Institute of Technology (MIT) that got a lot of publicity recently when they used 40-hertz light flashing into the eyes to treat Alzheimer’s in mice. Everybody sort of read this on the internet. They said this 40 hertz was like a magic frequency.

JM: That’s the gamma frequency in the brain, right?

MH: I believe so. Yeah. We did a study that found 10 hertz was better than CW and better than 100 hertz. If pulsing is better, it’s likely to be in that range and I completely agree that cells cannot respond to kilohertz. It’s just way too fast for the cells to even take any light at all.

JM: Great. Are there any other developments on the horizon that we’re unaware of that you have insights to because you’re networked in that community?

MH: In Rio de Janeiro, in the Olympics, there were a lot of light therapy devices. The competitors weren’t bragging about them too much because sports is a hugely sensitive thing for performance enhancement. All these drugs and supplements and things can be illegal. There is no conceivable sort of forensic test for having exposed yourself to light.

JM: Maybe in the future but not occurring at the same technology. That’s for darn sure.

MH: Athletes get huge benefits from putting red near-infrared light on their muscles. A lot of them use LED arrays. Some use whole body light beds. It’s a huge big deal.

JM: What would the intention be for the muscles that they’ve just exercised or they’re using most actively? It’s not going to improve endurance. It would just be muscle recovery, I would imagine, right?
MH: Endurance to some degree. I mean the time to exhaustion is extended with light therapy. There’s basically two ways athletes use. One is preconditioning before your sports event, and then there’s after, which helps recovery and delayed onset muscle soreness and all these things. If you combine light therapy with training regimens each day, do your training, you get light. You go on like that and you can train a lot more effectively. I think this is going to really spread.

JM: It’s exciting. As I said at the beginning of our interview, I’m really enamored with it because it’s so inexpensive and so safe and so natural. LEDs aren’t typically natural, but they’re replicating a natural source, which is the sunlight source, which we’ve had since our ancestors first existed, whenever that was. It seems that optimizing that exposure would be a simple strategy that can improve your biology with relatively little to no risk.

[-----50:00-----]

MH: I quite agree.

JM: Yeah. It’s great. I am just so delighted that there are committed individuals like you who literally spend decades in the lab trying to figure this thing out and help us understand how we could practically use this. One of the intentions of my starting this site was to radically decrease the time at which researchers like yourself, who committed decades of their life’s work developing these principles, to decrease the time treatment is clinically applied. Because normally in the past, as you know when you first started out, it could be half a century before this knowledge became common. Now we can decrease that time. Thank you so much.

MH: Yeah. We’re just coming up pretty much to the 50th anniversary. Endre Mester was the first one to start treating non-healing wounds in 1967.

JM: He did that with lasers, didn’t he?

MH: Yeah. He did it with the ruby laser and then the Helium-Neon (He-Ne) laser. For 20 years, everybody used lasers. But now, LEDs are rapidly taking over.

JM: Yeah. But as we mentioned earlier, photobiomodulation has been around for centuries. In the most recent times, Kellogg in 1910 and Finsen with the Nobel Prize in 1902 or 1906, somewhere around there. We’ve been doing this for a long time. It’s just that there’s this emphasis and encouragement in the conventional medical model to rely on expensive and dangerous medications because they can and they’re encouraged to do that rather than the simple strategies.

MH: Yup. Something like psychiatric drugs are just horrendous. They have virtually no positive benefits. They have huge numbers of side effects. Just putting a simple light on your head works downright better than these drugs.

JM: Yes, indeed. Alright. Is there any other insight that you’d like to share with us before we let you go?
**MH:** I think I’ve covered quite a lot of stuff.

**JM:** Yeah. We extracted it out of you and I really appreciate that because you’ve provided the parameters and the guidelines that we could safely and successfully integrate this in our lifestyle at a relatively low cost. Thank you so much for all your work and for sharing it with us. I really appreciate it.

**MH:** Thank you for giving me the chance to ruffle on. As you can tell, I like talking about these stuff.

**JM:** Yeah. You should. You’ve committed your whole professional life to it. It’s great to be able to share it.

[END]