Photobiomodulation: The Role of Light in Preventing and Potentially Halting Alzheimer’s Disease:
A Special Interview With Dr. Lew Lim
By Dr. Joseph Mercola

JM: Dr. Joseph Mercola
LL: Dr. Lew Lim
RZ: Dr. Reza Zomorrodi

JM: There is a tsunami of Alzheimer’s disease approaching us, and there are no effective drugs. What can you do? Hi, this is Dr. Mercola, helping you take control of your health. Today we are going to explore a simple strategy that can radically reduce your risk and probably serve to effectively treat many cases of Alzheimer’s disease. Today we have on our interview Dr. Lew Lim, who is a clinician up in Canada and who is an expert in the use of near-infrared therapy to treat Alzheimer’s disease. The extension of that, of course, is to prevent it. Welcome and thank you for joining us, Dr. Lim.

LL: Thank you for inviting me. Let me first say that I speak with some evidence. We have just been accepted for publishing into a scientific journal. Our recent case series report is a clinical study on a small number of people with Alzheimer’s disease. The findings actually are quite significant. Without going to the details now, we do get questions from skeptics like, “How can light actually reach the brain to begin with and then get a response from the brain?” What I’d like to do is to actually try and demonstrate that first, then you can see that this is not all hocus pocus. It’s actually doing something to the brain. Then we’ll talk about the evidence.

JM: We’ll talk about the evidence, the mechanism, and how this all works. There are a lot of associate details to this. Like most areas, the devil’s in the details. Why don’t you proceed with the demonstration and show us how light can actually penetrate the skull and have influence on brain activity.

LL: Okay. I want to introduce Reza Zomorrodi. He’s going to take over the interview from me. Reza is one of the top neurophysiologists in Canada. He’s attached to the Center for Addiction and Mental Health at the University of Toronto. We’re now actually working on more developments. We’re at the cutting edge of getting images of the brain so that we understand better why some people are responding better than others. Say, even in Alzheimer’s, we are noticing that some people respond virtually immediately, and some are responding a little bit later. That is giving us more detail. Hopefully in the future, we can actually customize intervention. We’re really going to customize medicine here. Just to show you what it does, let me just pass over to Reza.

RZ: Yeah. Hi, I’m Reza. I’m practicing neurophysiology at Center of Addiction and Mental Health, University of Toronto. I have many years of experience with the electroencephalogram (EEG) and recording their physiology. This device really got my attention. For myself also, it was a really big surprise to see how the light could change the EEG and the brain signals, because the brain signals, or the language of the cells inside the brain, I believe it is the electrochemical signals. We can detect the electrical activity on the surface of the scalp. As a result, we expect it to interface
with the brain, with the electrical or magnetic stimulation. The light stimulation or photostimulation was kind of the surprising innovation for me.

Fortunately here, we have the device. We have a really high quality device. We can record in high-level, closer to clinical standard EEG, and explore the effect of the photostimulation in the brain through the EEG and the change of the power spectrum or the frequency. These are the settings we have here. We have an EEG with 19 electrodes at 10-20 montage. This is [a] very standard montage so we have the location of the electrodes according to the standard. We put the device on the surface with the different location that we are stimulating.

**JM:** The device is the photostimulation approach that you’re using to measure the impact on the changes in the neurological activity.

**RZ:** Exactly. This is the goal. We want to see it here in the live when we turn on the machines how the brain responds to these machines. It is an accurate and immediate effect, but the mechanism, probably later Dr. Lew will explain for you, but we believe that it is kind of interacting with the ATP, with the mitochondria activity. It boosts the energy of the brain and the brain uses this energy to generate more frequency, more oscillation, and organize or coordinate different networks. If you let me, I can start trying showing some …. 

**JM:** Sure. Go ahead.

**RZ:** Okay. In the background, what you see is the electroencephalography signals from 19 electrodes. I will ask Glynn to close your eyes. When we are closing the eyes, the main frequency happens. This is very well-known. It is the alpha-frequency. We can see the alpha-frequency very clearly in the data, and also the location of the brain with the activity. I’m going to show you where that alpha activity is inside the brain.

This is a live demo of the brain activity in the alpha-frequency. Most of the time, you see the green light. Green light means the activity is in the normal range. If it is showing the red, it means it’s higher than normal, and the blue, it’s less than normal. This is kind of the standard z-score activity.

We are recording about five or 10 minutes of the rest EEG to have the baseline activity of the brain. Then we will turn on the machines, switch on the photostimulation. We will see how this frequency is changing. Brain frequency, we define it in five different frequency bands, but they are not really separated. They are always interacting. Maybe the alpha is interacting with theta, maybe interacting with the gamma. They have different origins and different function, but at the same time, they coordinate together to process the information.

But for the rest EEG, when the subject’s sitting comfortably on the chair and not processing any cognitive task, the alpha is the dominant frequency. That’s why we are concentrating mostly on the alpha because it’s the biggest frequency, and right now the brain is in the alpha state. For all the research, we usually recorded 10 minutes then we go turn the machines on, and after that, what is the effect of the machine on the brain. We can ask Glynn to turn on the machines and we’ll see the effect on the brain.
**JM:** The machine, just for clarification, the instrument he’s turning on, is the photostimulation device that’s allowing near-infrared radiation to penetrate to the skull and to the brain.

[Interviewee demonstrates photobiomodulation device]

**RZ:** I’m not sure if the picture is clear for you, but you can see this green immediately went to the red. It means higher activity and really the machine is transferring energy to the brain.

**JM:** Normally, red is viewed as an alarm or danger signal. What does it indicate in this instrument reading?

**RZ:** Red basically means we push that frequency up. The brain has more power, more energy for that specific frequency. It is more than normal.

**JM:** Okay.

**RZ:** Before the machine was on, it was green. It was in the normal range. After we turned on the machines, we boost the brain power so it went to the alpha.

**JM:** You’re measuring this by the frequency of the electrical signals coming from the brain. You’re not measuring the light that’s entering. Is this an indirect consequence of the light therapy?

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**RZ:** That’s exactly a very good point because this machine is working in the gamma frequency. The frequency that’s stimulating the brain is about 40 hertz. But what we are seeing is 10 hertz stimulation, 10 hertz frequency.

**JM:** Let me step back here a moment. The observation in the brain is that you’re getting 40 hertz signal, but the therapy that you’re administering is 10 hertz. The light is pulsing at 10 times a second.

**RZ:** No. Actually, inverse.

**JM:** Oh. It’s the inverse. Okay.

**RZ:** The stimulation is 40 hertz.

**JM:** The stimulation is 40 and the effect is 10. Sorry, I got it mixed up. If I got it mixed up, I’m sure other people did, unless I’m the only one that’s not following it. I was confused. Thank you for allowing me to clarify that. It will reinforce what we’re seeing. Because this is not necessarily easy to follow and it helps to reinforce it from a different perspective occasionally.

**RZ:** Yeah. But this 10 hertz or alpha frequency is not the only frequency we are targeting. Because (of) the brain network that’s responsible for generating different frequencies, they are all interconnected.
We have a concept in neurophysiology. We call it cross-frequency coupling. It means if you boost or modulate one frequency, because of the interconnected network, you may modulate the other frequencies as well. If you are stimulating brain at the gamma frequency, you might also change the other frequency band, like the theta, alpha, or the beta. This changing or modulation could help or sometimes could stop or help any cognitive task.

Alpha, it has been shown, it is a very important frequency for rest. Also, we find it in some mental health disorders, this alpha frequency usually is very low or very slow. Pushing the alpha up and normalizing the frequency is really helping for cognitive skills.

**JM:** Welcome back, Dr. Lim. That was a very impressive demonstration. What I did not mention earlier is the term that’s given to the type of therapy that you’re administering there and what we’d like to discuss and expand on so people can understand what we’ve just witnessed is a term called photobiomodulation. You can see it. You just break down the word: photo, obviously light. When you’re administering light to someone’s brain through the skull, you see biomodulation – bio, being biology, life, and modulating is changing. We saw the light impacting the skull, changing neurological activity.

We can discuss this some time, but I thank you for making it available. It’s not something we typically do on our interviews, but it was a powerful illustration of the technology. I think we need to backtrack now and really lay a foundation of what’s going on.

What we’re administering is near-infrared, or what you’re administering and have done a lot of work with, is near-infrared light. You can discuss those frequencies and the mechanism, which we think works is because near-infrared is interacting with one of the proteins in the inner mitochondrial membrane, part of the member of the electron transport chain, cytochrome c oxidase, sometimes referred to as CCO. This is a chromophore, which means it is a molecule which tracks light like a magnet and actually feeds off of that. I just want to go on a little tangent because this is important. The frequency that it is, is in a near-infrared range, about 810 or 830, somewhere in that range.

The concept I want you to explain – I’ll hand it over to you in a moment – is that most of us don’t understand that when we eat food as fuel, we think that’s going to nourish our cells. It does, but it does it only indirectly. There is no way the macronutrients you’re eating are converted. They kind of leak through. You break them down in your gut. They go into your bloodstream, and they go into your cells and feed them. That’s not the way it works. It works only indirectly.

It works because those molecules get broken down, essential ingredients like the fat and glucose, into pyruvate and they feed the mitochondria. The mitochondria will generate the energy. Ultimately, they’re processing electrons to generate adenosine triphosphate (ATP).

But here’s the key – I just want to finish this thought – is that that’s not the only source of energy you get into your body. Hardly anyone, virtually no clinicians, understand this. It’s that light is a powerful fuel for your body. I believe, it’s my serious belief, that this is one of the reasons we have an epidemic, as I referred to earlier, a tsunami – it’s a literal tsunami – of Alzheimer’s disease that’s going to devastate our country, unless we understand this concept. But we have to fuel our
body and our brains specifically with this light, because as we’ve seen, it comes in there and it feeds our mitochondria, just like food.

With that preface, I’ll hand it over to you and you can go off. I’ll guide the conversation as we go on, because there’s a lot of other concepts I want to interject here, because it’s really important and it’s not one we really talked about a lot previously on the site. It’s a new evolving passion of mine, photobiology. I’m just delighted to connect with experts like yourself.

**LL:** You’ve just touched on several levels here. Let me start with one aspect. You talked about the processing of glucose and to convert it to energy. That’s one way the mitochondria converts the energy. Now the other major, major way it does is to process oxygen by the mitochondria. The cells love oxygen. The cells love oxygen a lot more, say for example, than cancer cells, which basically thrive on burning sugars. That’s an example.

**JM:** Let me just interject here. What you said is a bit confusing. Yes, that’s true. But the way that oxygen interacts here is that those electrons that get broken down from the fuel get passed through this electron transport chain. They ultimately get passed off to oxygen, which accepts it and forms water, and sometimes it forms these reactive oxygen species. But it’s these transfer electrons that get the cycle rolling within those mitochondrial electron transport chains to generate the ATP. But that’s only one way.

**LL:** Yeah. That’s just one way. I was going to bring in oxygen because photobiomodulation actually does improve oxygenation to the cells. One of the ways it does is it releases nitric oxide back into the body. Nitric oxide relaxes the blood vessels, vasodilatation. It does that. That’s one way of looking at what it does. Now, that is part of the mechanism that’s happening within the cells.

Now, the really interesting thing is when you can deliver red and infrared light to the mitochondria in the cells, that leads to, other than releasing nitric oxide back into the body, it then leads into synthesizing gene transcription factors that lead to the repair of cells. It helps with cellular recovery. The neurons, which we are kind of focusing on right here, is just another cell with mitochondria. It accepts the light in the same way and converts it into synthesizing the transcription factors that lead to that.

**JM:** Let me just interject you for just a point of clarification so people understand this. The neurons that you’re referring to are part of the brain. The brain is one of the most mitochondrial dense tissues in the body, along with the heart. That’s why it’s a great organ to study for mitochondrial activity, because it’s so dense.

**LL:** Directing light into the brain this way is actually very interesting. You started off talking about Alzheimer’s disease. Before I get into the evidence we found in our study, if you look at the epidemiology of dementia and Alzheimer’s [in terms of] globally, what I found was countries that are in the northern hemisphere appear to have high risk of developing dementia and Alzheimer’s. You look at the top 10 countries, they’re all countries with winter, with shorter hours.
You’re an advocate of being in the sunlight. I think that is really what people ought to do. But in the north, there’s not enough sun for you, right? In a way, what we’re doing here, directing light into the brain – literally lighting up the brain as you can see from the computer images – have a, you might say somewhat of a similar effect as sunlight but probably is more targeted.

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It has specific wavelengths that have an effect on the mitochondria of the neurons. Logically, that will lead to neuronal recovery if the neurons are performing sub-optimally or even damaged. That’s been found in in vitro studies.

Before we did the study on humans, they’ve already had at least three published studies of work done on mice and rabbits. When they directed red and infrared light to the brain, they found that the commonly accepted biomarkers, the amyloid beta plaques, actually are reduced. The behavior got better. The mice were able to find their way better. They have better sense of direction and so on.

What we’ve done is we didn’t invent the whole idea of this photobiomodulation can help in dementia and Alzheimer’s. It has been done. But I think we are the first to complete an albeit small study on humans that has given us a very significant result.

When we did a head to head comparison with the drugs with the information we had from the pivotal trial with Aricept, which is commonly prescribed for Alzheimer’s, the data we got was seven times greater with no side effect. I think the key is not having a side effect. The safety is pretty much confirmed. I know that it’s a small study. People are going to come out to me and say, “…hey, you know, this is just…(questioning the significance)…”. Actually, we are reporting on five people on the devices that direct near infrared light to the brain, and ALL of them responded positively.

**JM:** This study that was published, the primary investigator was Dr. Michael Hamblin or was it yourself?

**LL:** Dr. Hamblin is a co-author. I’m the inventor.

**JM:** The primary? You’re the inventor of the device, but Dr. Hamblin – is he a cell biologist at Harvard? I’m interviewing him shortly, but I’m not quite sure what his professional degree is.

**LL:** I’m glad you’re interviewing him. He’s really the guy you’d want to speak to because I think he kind of owned this whole knowledge on cell. He’s not the only one, but he’s highly cited. He’s presented many papers out of his more than 300 articles and a few books. He really truly understands what’s happening in our cells. He’s one of the co-authors of the study. The principal investigator was Anita Saltmarche. We did it mainly in Ontario, here in Canada.

Now, I was going to go on to this. I anticipated criticism that this is a small study. You can’t make a claim out of that. We’re going to bigger trials now. This next trial that we’re doing involves 226 people. It’s randomized, double-blind, placebo-controlled. Basically, the study will be out of my hands. It will be led by a professor of epidemiology in the University of Toronto. We’ll have
collaborators from Harvard and Boston University. It will involve quite a number of people. In the meantime, we are also doing a smaller study to get quicker data from about 40 people, which are also rigorously controlled. We’re taking next steps just to prove this out.

**JM:** Okay.

**LL:** We have a lot of stories.

**JM:** Yes, you do. Let me just emphasize a few points as I’ve mentioned earlier there. You highlighted that there is no effective drug for Alzheimer’s. Any drug that is used or administered only treats the symptom. Nothing, just like most areas of medicine, treats the foundational cause of the illness. I just watched a one-hour special on PBS last night about the Alzheimer’s epidemic.

**LL:** Right.

**JM:** It was really good. We’re going to hopefully stream that on our site and have further discussion on this, maybe even embed your interview. I don’t know. It just hit me when they said over and over again – obviously they highlighted the human components of this, and the personal trauma and challenge. When you have Alzheimer’s, you’re not really mentally competent. Who’s going to be an advocate for Alzheimer’s patients? It has to be a family member because they can’t do it. They’re crippled, mentally crippled. It’s an epidemic. We don’t have a good solution. This is good.

I want to focus back now on the practical strategies. You’ve given some very compelling evidence. You’ve published work with some leading, very well-respected researchers, that this could be effective. One of the reasons I started this site is to radically reduce the time that information, which great researchers like yourself have compiled and put together, to reduce the time it takes for that information to be known and understood and then transferred to the general public. That’s what I want to do with the rest of this discussion. What is the take-home message?

Now, you referenced earlier – we’re going to include this because you sent me a five- or six-page draft of an article prior to our interview. It had some really good grasp in there that was really profound, that they did never even address in this PBS special. It’s so obvious. It’s just like vitamin D. The further north you go, the less exposure to the sun, the higher the risk of Alzheimer’s. Why isn’t this known? I’ve never even realized until you sent that to me. I thought I followed this pretty closely. I obviously didn’t. If I missed it, almost no one gets that. We’re going to put those stats in there because it was very interesting, the tables you sent over. We’ll highlight that.

The take-home message is live south. That’s one of the reasons why I moved to Florida. That’s what you need to do. It’s not just living in Florida or the Middle East or Africa. You have to be outside with a lot of sun on your skin, ideally. Obviously, the brain is going to be in your head, but that’s the key. That’s ideal. If you do that, you’re probably not going to get Alzheimer’s. But if you do, then there are targeted therapies like yourself. I guess that’s one of the things I want you to address: the difference between the sun and some of these targeted interventions.
What you have on cover, the single best term I could describe it is “profound.” The implications are actually beyond profound. The simple application of light can have such a radical improvement on a disease that’s going to devastate our society. Why don’t you address the sun issue and then how your version differs? Before we do that – I know I’ve been going on for a while – but most people don’t understand that over 40 percent of the energy in sunlight, 40 percent, is near-infrared. Maybe there’s some benefit to it.

LL: You’ve got something there. Say you live in the northern hemisphere and you know you’re not getting enough sunlight; this is one really easy way to do it. There are people living in the tropics getting Alzheimer’s as well. There might be other factors that affect it. But if you look at the statistics, most of the Alzheimer’s are really in countries where there’s not a lot of sunlight. This is really the intervention that we have here, it’s a really simple way (alternative). I like to make it really simple - this is key.

Here’s an interesting thing that we found in our study. We did 12 weeks of active intervention. We have, actually, four weeks of no intervention at all, after the 12 weeks. We found that a number of people actually went straight into decline. We had some measure of modifying the disease. I don’t know yet until the bigger trial. But it showed that Alzheimer’s is a strongly degenerative disease. It has a whole lot of power on its own. You’ve got to keep doing it regularly even with what we have. The key here is to make it really, really convenient and simple. You can’t be going to a clinic the rest of your life and get treated, especially if you’re living far away. It would cost you a lot of money.

That’s the idea behind my invention. It’s to make it as simple as possible. You’ll just press the button and that’s it. The treatment is 20 minutes. You can do it the rest of your life because you just put it on your head and your hands are free. You can go to bed with it. That’s really the principle behind it.

Now, I think this also works because it is simple and yet it is complicated. It is complicated in the mechanism. It is simple because all you do is direct the near infrared light. In our case, we direct it to the nodes or the hubs of the default mode network (DMN). The default mode network is highly correlated with Alzheimer’s in brain imaging that goes back to the mid-2000s. It’s pretty well-established.

The key for me is to have an intranasal source, because it is really close to – you might say close to the hippocampus, which is very closely related to memory processing areas. But the olfactory bulb, which is really just right above the nose, has direct projections to the entorhinal cortex and the parahippocampal area, the memory areas. If you treat that, you’re strongly treating the hippocampus if you look at the anatomy and the science. Now, we have done this. It’s really simple.

Here is how we can compare to drug research and development. Drugs have to target a molecule. If you look at the whole pathology of Alzheimer’s and how different proteins are involved, and (what) a lot of these (research) are now focusing - some of these Phase 3 trials are really involved in addressing the amyloid beta plaque side of it. There is another side, which is basically based on
the tau proteins which lead to the neurofibrillary tangles. But if you look at all the proteins involved, there are a lot. I don’t know how many.

Drug companies now, especially those who are on the amyloid beta cascade hypothesis, are going back (to) earlier (stages) because they’re not getting results from more advanced stages of Alzheimer’s, moving towards prodromal, before the symptoms come out. We have shown, perhaps through imaging, you should be able to trace a biomarker in some way, that you have amyloid beta plaques (to have a chance for these potential pre-symptom treatments). That is saying that, “Okay. You’ve got Alzheimer’s. You’ve got all these symptoms. There’s no hope for you. It’s too late.”

What we have here is we’re demonstrating in our study that we’re actually continuing to get results. People with more advanced stages are responding. It is dramatic. Perhaps one day, you might have the opportunity to interview some of these people. It’s going to be fun. I think that is going to be the difference. Light therapy is kind of holistic. It’s natural. There’s no side effect. It kind of gets the brain to do its work. It does not do the work on its own.

There are other ways, maybe trying to actually target the biochemistry. That is, I think, is one difference. We are looking at ways to make it more effective. Our next study is going to be an improved version of what we’ve used in the earlier study, because we’re introducing, as Reza had demonstrated, gamma frequency, which is 40 hertz (or) 40 cycles per second, into the brain.

Now, what happens in gamma is when it is present while your brain is consolidating memory, it actually kind of minimizes or prevents overactivity. You might call it hypersynchrony. There are some excitotoxins being formed. It leads to the amyloid proteins that are actually antibodies, trying to fight it and get into a situation where you start developing a lot of it and developing the amyloid beta plaques.

Now, earlier studies that go back two or three years, have shown that when gamma is present, it actually avoids that and therefore actually kind of avoids the formation of these plaques. What’s really interesting is MIT came out with a huge and I think, fantastic report on this particular frequency of gamma on mouse models. To cut it short, they found that when the mice are in an environment where the light is flickering at 40 hertz, they actually notice that the amyloid beta plaques are reduced significantly. They do it once a day for an hour for seven days. Very significant.

But here’s the detail. They found that where it’s reduced actually is in the visual cortex, that part of the brain that processes what you see. This flickering has been kind of received by your eyes and processed there. That particular part of the brain has amyloid beta plaques reduced. But what people haven’t noticed is when they checked the hippocampus, where the memory processing area is, there’s actually no change. The message is if you can deliver flickering light of 40 hertz to the part of the brain, either directly or not directly, where it’s processing the information, you can actually reduce the biomarkers in that particular area.

That leads us to develop something that’s more comprehensive, instead of just being in an environment where it flickers, we are redirecting 40 hertz to the hippocampus, like I said, effectively perhaps through the olfactory, directly to the hippocampus. We are (also) directing to
the hubs of the default mode network. Based on this hypothesis – I have to say it’s an hypothesis because we haven’t yet proven out in the big trial, which we intend to do. I actually do expect pretty good outcomes for even more advanced Alzheimer’s patients. These people are basically told, “you have no hope”. I hope to provide some hope!

**JM:** Good. Let me just mention too sort of a comment I just recalled as I was reviewing the PBS member in the PBS documentary I watched, because there’s a little bit of confusion. We talked about people living north having a higher risk of Alzheimer’s disease than those living south. But the state with the highest percentage or number of Alzheimer’s patients in the entire U.S. is Florida. They live in the right state now, but they came there like way too late. They didn’t live their life in that state and didn’t get exposed. I just wanted to clear up that confusion.

I don’t want to give a false impression that this light therapy that we’re discussing here is some type of magic bullet. Is it useful? I’m absolutely convinced it is. But it’s not the magic bullet. You mentioned that there are people who live in the tropics who come down with Alzheimer’s. Surely there are some other variables. What I want to address is this *Fat for Fuel*, the book that I wrote, that discusses how to get your body to burn fat as its primary fuel. There’s a lot of research that show that once you do this, you upregulate your mitochondrial function, which is at the heart, really the foundational cause of this.

Part of the process of developing the ability to burn fat as your primary fuel is something that we use. It’s called Peak Fasting or intermittent fasting, regular days of fasts, maybe even longer – a day, two days, three days. When you do that, your body starts conserving protein, but it also starts breaking down protein in your body. What is the marker for Alzheimer’s disease? Beta amyloid plaque, which is protein. Tau protein is another protein. Your body starts digesting this. At least that’s what Dr. Jason Fung does in Canada. I think he might even be at your university, Dr. Jason Fung at the University of Toronto. That’s a powerful intervention. I think there’s a powerful synergy between getting the diet right and getting the light exposure.

Let’s go back to the device that you put together because we haven’t really discussed it yet. It’s infrared light. Other than it administers this, there is a number of different components. You have the light wavelength, which is about – is 810 (nm) or 830 (nm)?

**LL:** 810 (nm) is near-infrared.

**JM:** Okay. They’re both near-infrared, but 810 is the one your selected. Some say that 830 might be better. But for whatever reason, you picked 810.

**LL:** I can give you the reasons.

**JM:** Okay. Maybe we’ll discuss those, but that’s a fine point. But essentially, it’s near-infrared and it works. It clearly works. You’re administering this through these light-emitting diode (LED) modules. You’ve got like four of them on the scalp. They’re held together in this sort of metal frame. Also, you have an intranasal LED, which puts it back up. You’ve got five sources of LED light going, and it’s pulsing currently at 10 times a second, or 10 hertz.
LL: That’s the Alpha model.

JM: I don’t think it’s available yet, or is it? What you’re talking about is still in research and development (R&D). It’s not available yet.

LL: It is available. Actually, it is available this week. We just got it out.

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What I found was, in view of the discussion, I can see how gamma is really going to affect Alzheimer’s but there is some trace of people using gamma and getting some slight agitation and hypersensitivity to the environment. But alpha, which is 10 hertz - that was in the original study. It is used by a lot of people now. It has a lot of good effects.

I picked 10 hertz mainly because – Michael Hamblin can talk to you about it – because he did an animal study and looked at different pulse frequencies and found that 10 hertz actually – you can interpret it as accelerating the recovery of the neurons in the animals. His lab simulated traumatic brain injuries in the mice and then tried to find a what (pulse) frequency (works best) at 810 nanometers, which is what we’re using here, gives you the best chance of healing and quickest healing. They used something called the neurological stress scores to measure the least stress on the brain, which is really at 10 hertz. We actually have adopted 10 hertz mainly for its ability to cause or stimulate the neurons to heal. That’s the reason for 10 hertz. It seems to be generally great.

Now, 40 hertz —

JM: That’s gamma.

LL: That’s gamma. 40 hertz. Actually, to be fair, I didn’t know that it has the effect of reducing the amyloid beta biomarkers until the MIT study recently. Now, we’ve got 40 hertz. Yet to be proven in a rigorously controlled trial, but people that are being treated to this are showing actually quite dramatic results. Maybe, like I said, maybe one day you might want to interview them.

JM: Sure. Yeah. That would fun. I’m convinced from the evidence that I’ve seen and reviewed that if you know someone who has Alzheimer’s – this is a serious problem, obviously. It’s typically pre-terminal. Here’s the issue. It’s going to cost us more. It’s going to be the biggest cost of our healthcare. Most of the people that have Alzheimer’s are obviously older. Medicare picks up some of the cost.

What they don’t pick up is the enormous cost of caring for these people, because these individuals are so impaired, especially at the later stage of disease, that there’s no way – obviously, they can’t live by themselves – but they need someone full-time to take care of them. They will be dead. They’ll leave the stove on or start a fire or something. Someone has to watch them. They have to be cared for 24/7. That’s expensive. We’re talking 3,000, 4,000, 5,000, 6,000 dollars, not a year, every month, that they have to pay to be in one of these assisted care facilities. The device you put together costs about 1,500 dollars.

LL: Seventeen-fifty, actually.
JM: I think it’s about 1,500. It’s less than 2,000 dollars. It’s a small fraction of what you would pay for a month of assisted living. If it can provide that type of relief and give the person their life back, allow them to interact with their family and friends, I mean that’s just incredible. There’s no doubt in my mind if I had someone close to me – fortunately my parents don’t have Alzheimer’s and they’re close to 90 at this point. They had the preserved mental facilities. But I would be putting them on that in a heartbeat.

I may be wrong... when I heard your initial interview on Ben Greenfield, I said, “Oh. This isn’t for me. I get sun exposure all the time.” For those of us who are younger – I actually was at a presentation in West Palm Beach last weekend. One of the presenters gave evidence that almost everyone over 30 has some form of Alzheimer’s, although it’s really mild. All of us have it to a certain extent. But I’m wondering. I’d like you to discuss this concept. Ideally, I think everyone could use this preventively, but I don’t think it’s necessary. I think if you’re proactive, and understand that we have a tsunami of Alzheimer’s coming and you need to take aggressive, proactive, preventive measurements, the best one is to get on the sunshine every day.

Second best, I think, and this is what I want you to express, especially with the energy transfer. What we didn’t talk about is fluence or the energy radiance and energy density of the light being transferred, because there’s a Goldilocks dose. You can get too much, you can get too little. You’re an expert on that. I want you to address it. But I want to really integrate this into the recommendation that we’re providing people. If you want to be proactive and preventive, then get in the sunshine. That’s the best. There’s no charge for this. It’s free.

If you want to take another step up, what I’m actually doing personally and playing with is a handheld device that’s a heat lamp that I just rub over my head. It’s a 10-watt bulb. It clearly is near-infrared. It’s an analog. You get the whole spectrum, not just 810. You get 810 and up to 2,000. You just spread it over the head. Your device only hits certain areas, whereas if I get this device, I can hit the whole brain. I’m wondering if you could comment on that strategy: the sun exposure and this infrared bulb as sort of an intro-preventive strategy, as opposed to the neural device that you developed.

LL: The device actually eventually reaches the whole brain because you’re pointing at very active hubs. They communicate and eventually do that. I think the nose is very key because of its proximity. It’s really easy to reach the brain. We know now that if you can deliver the near infrared light to the brain, it does good things. The whole thing is meant to be really convenient.

The other method, you can actually direct high energy near infrared light to the brain. The principle is very similar. It should work. It could be a matter of convenience. I try to make it very simple. It runs on rechargeable battery. You just charge it like a cellphone and it does that. There’s no one way.

Here is the thing that I might want to touch on. Mike Hamblin might probably do that too on this biphasic response, as we call it. In the field of photobiomodulation, low energy is good because studies have shown that either can deliver just one joule, it’s very little, to the cell. Just imagine. The cell is micro.
**JM:** For those non-scientist and/or physicists among us, which is the majority, can you explain what a joule is?

**LL:** A joule is actually a measurement of energy. It’s a function of power and time. You might want to have a very low power and more time because of your body. I start (the formula) with 20 to 30 minutes because this is generally the amount of time that your body needs to get into the healing process. You can have high power and still arrive at the same joule in a very short time. I start with that. It’s also good because then I can have the safety aspect of it coming in. Keep it low power.

When you have high power, there’s also the possibility of getting the thermal effect. Thermal is generating heat. In the law of physics, energy cannot be created or destroyed. You have a lot of power. Energy’s got to go somewhere. It does work in the development of heat, but the mitochondrion doesn’t need heat. All it needs is the photons. I try to keep it low.

**JM:** Wait. Let me just back up for a point of clarification. Heat, in my understanding, is infrared. The heat that’s being generated, wouldn’t part of that be infrared radiation that’s transferred to the mitochondria? Or am I mistaken? Is it a flawed concept?

**LL:** Photobiomodulation actually, if it’s done correctly, it is a non-thermal effect.

**JM:** Interesting.

**LL:** No heat.

**JM:** Okay.

**LL:** Just the photons. Now, you get heat mainly because the water molecules are being activated. That generates heat. You feel comfortable. It’s not a bad thing, provided that it’s not too hot. But it doesn’t do anything in synthesizing gene transcription factors.

**JM:** What it might do, and I think this is one of the reasons why being exposed to the sun is so useful – We talked about cytochrome c oxidase being energized and providing ATP, but the other function, and actually I read in Dr. Hamblin’s paper, is this higher portion of near-infrared close to 1,000 or a little bit higher or maybe up to 2,000, that stimulates or resonates in the water molecules, that recharges their ability to store energy as a battery, then transfer that energy as another source of power to the body.

**LL:** Yeah. You actually have a different chromophore at the longer wavelength, in this paper you studied is in 980 (nm)?

**JM:** 980, right.

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

**LL:** That is out of cytochrome c oxidase. Here you’re talking about water as a chromophore in the cells, receiving that (energy). They’re opening up the ion channels and does pretty much a similar
thing. What was interesting is they were wondering why in some people, the lower wavelength light of using 810 (nm) is working when they do at a higher wavelength, it doesn’t seem to be working, but in some other studies it’s working. It appears that water as a chromophore actually activates a very, very low power. More than that, it just doesn’t do anything, other than say creating heat. It does work. I don’t know yet how far it goes before it actually stops working.

**JM:** Because of that biphasic effect that you referred to. It’s not intuitive that there’s a dose that will actually improve it, and then there’s another dose at a higher level of battery transfer that will actually worsen it or inhibit function.

**LL:** Let’s go back to this. This has relevance to the whole history of photobiomodulation, when it was low level laser therapy before. Now if you think about it, this whole thing started when laser came about.

In the early days, let’s say in the ‘60s, laser was used to cut stuff, destructive, remove scars, shaving off materials and so on. High power laser you can associate with this destructive [effect]. The whole idea about low power laser actually doing the opposite virtually came up by accident by a Hungarian professor. He published his paper in ’67.

When he shaved off the fur of the back of the mice in one group and another in a control group, he found that when he directed the laser on very low power, the fur on the back of the mice grew more quickly, at least double. There’s something to it. This is completely new. It’s a huge discovery. Then more experiments were conducted and found the therapeutic effect of low level laser. Then later on in the ‘90s, I think it was promoted by NASA. They found that, “Hey, you know what? Actually, you don’t need laser. All you need is to deliver that wavelength into the cells and the cells will process it and you get the same effect.”

**JM:** It wasn’t just near-infrared. It was the red, too. Like 650 (nm) and 660 (nm).

**LL:** Red too.

**JM:** There’s red and the near-infrared and probably different ranges in the near-infrared are useful. There are probably three sweet spots.

**LL:** In the early days, it was visible red. They created a laser through helium-neon gas, which is 632.8 nanometers. Today, we have 633. Some of the early research found that particular parts of the spectrum – they call it the action spectrum. There are certain parts of the spectrum that actually does work and a certain part of the spectrum that actually does nothing - I think we’re talking about the 780 and 790 - that part of it is a waste of time. Where it is actually matters. But it doesn’t explain clearly because these are clues and indications. We found that even 650, which is not identified as part of the action spectrum, has been effective. That’s quite a big window.

**JM:** Yeah. I want to get back to the preventive recommendations. I asked this question initially, kind of hold you to the fire and see if you could answer that, especially when you just commented that there appears to be sections of the spectrum. When we say 780, 630, 810, we were talking
about nanometers. This is the wavelength of the light. You referenced that there are sections that appear not to have any biological benefit.

That kind of reminds me of the early days of the human genome project when we thought there’s these massive sections that were junk DNA. “We don’t need this.” Now we’re finding that’s more important than the regular genes. This is because we didn’t know. I think we may be too early at this stage.

I tend to refer back to a lot of the pioneers that have done this work 100 years ago. They didn’t know even a fraction of what we know now, but they had an analog approach on the whole spectrum. We acknowledge that people living down south have a relative resistance because they’re getting exposed to the full spectrum, which clearly has a near-infrared but it has all these other frequencies. There might be some other benefit that we have yet to figure out. Actually, one of the benefits of the infrared that you said was growing hair on the mice, but they actually have LED devices that you can buy now on Amazon.

**LL:** The red.

**JM:** Yeah. The red. I’m sorry. Red. To grow your hair. But they can be 100 [dollars], a few hundred or even more. This device I referred to earlier is only 27 dollars. You can just rub it over your head and get the same benefit. It’s not an LED. It’s a heat lamp. It’s an analog. It’s a lot less expensive. Comment on that as a preventive strategy, and also the sun, and help us understand the difference because it has to do with this energy density, this joules per square centimeter of energy that’s transferred, which may be too much when it gets to this biphasic approach if you have too high a dose versus too low a dose. It’s a complex process to understand, but I think it’s important if one seeks to apply this information to themselves personally.

**LL:** First and foremost, I think the sun is great. Probably the best if you can go under the sun, as long as you don’t get overexposed to ultraviolet (UV).

**JM:** Right.

**LL:** Yeah. Maybe 20 minutes a day in bright sun, something like that. I think that’s really the most natural.

**JM:** It depends on the season. In some cases, the skin color, the latitude and the altitude. For some people, it might be three or four minutes. For others, it might be four hours. It really ranges.

**LL:** Absolutely. Quite right. That’s probably a great way. The lamp, I tend to put safety first so I try to keep it as low power as possible, as long as it activates what it does. When you have near infrared, when you know it penetrates quite deeply, you don’t actually need a lot of power.

**JM:** How deeply would you say, from your experience?

**LL:** You just saw the –
**JM**: From the EEG. What were you able to correlate? Will it get 5 centimeters, 6 centimeters to 8?

**LL**: The only way you can measure with the light meter is in a cadaver.

**JM**: That’s not a biological system.

**LL**: Yeah. That’s not a real thing. People imagine that it goes down to 5 centimeters, depending on the power. If you use laser, it probably goes actually more deeply. If it’s near-infrared, actually experiments have found that 810 nanometers actually go the deepest, especially in the live environment. Why is that? It’s because as you go beyond 810, it gets absorbed by water more and more.

**JM**: Water. Right.

**LL**: The absorption is actually exponential.

**JM**: Yeah. That’s right. 810 doesn’t power water. It powers the mitochondria, the cytochrome c oxidase, specifically. But it’s the marriage of those, the powerful synergy where you’re getting the same intercellular storage and your battery and recharging the mitochondria. It’s just like so crazy. It’s such a simple concept. The more I study medicine and health, the more you realize how simple it is. But there are a lot of complexities to it. Thank God there are researchers like you to help us figure it out.

**LL**: Yeah. There’s a community of us actually. I’m not the only one. I think some of the work that’s been done before me has been really, really useful. I’ve got to give credit to a lot of these people. But we’re still discovering. I don’t think we are anywhere near what we need to know. I’m doing my part in trying to reach perhaps into customized medicine. I think our research in integrating EEG is cutting edge. The more data we have, the more we’re able to identify profiles with different levels – like I said before, Alzheimer’s is different – different levels of Alzheimer’s and how we’re going to deal with that.

There are other conditions as well, even traumatic brain injury. Research was done, particularly by Margaret Naeser of Boston University. She’s done more than 10 years of work in looking at the effects of photobiomodulation in the brain. She’s one of my co-authors, by the way, in our last study. The only thing that I need to do is to put that all into much larger clinical trials. That’s pretty expensive.

**JM**: My guess is that it would also work for all the neurodegenerative diseases. Not only Alzheimer’s, but amyotrophic lateral sclerosis (ALS) and Parkinson’s. Parkinson’s is not as common as Alzheimer’s, but it sure is devastating.

**LL**: Yeah. I think Parkinson’s, in my opinion, is more complicated to treat from photobiomodulation because if you direct in some ways, it’s not reaching the substantia nigra or maybe the basal ganglia and so on. But we’ve seen Parkinson’s patients responding. But it is much more varied.
I think what we need to do is to point the near-infrared from the back, here, below the occipital area, called occipital protuberance to the substantia nigra. We’re actually working on that. Let’s see how that pans out. I think, theoretically, that’s going to help.

**JM:** Okay. Good. I wanted to give people strong, concrete, clear recommendations. Before we go, I want to beat this thing again. To let people know, it’s not just the light. That’s not a magic bullet. It’s an important part of it, a vastly unappreciated on. One of the keys is to get your body to burn fat as a primary fuel because that will fuel your mitochondria. Ultimately, Alzheimer’s is a mitochondrial dysfunctional disease. If you’ve got impaired mitochondria, you’re not going to...

That’s the reason why this infrared works. It’s charging up your mitochondria, cytochrome c oxidase specifically. Now, if it didn’t work that way, you wouldn’t see the results that we demonstrated earlier. The practical thing, I think we’re all in agreement, if you have advanced Alzheimer’s – that’s a serious problem – then the targeted therapy that you developed is great.

Now, you also have an intermediate device that’s just the nasal probes only. I’m assuming that’s less. Then the two steps below that, preventively, it would be fair to summarize that to be preventive, get out in the sun as much as you can. If you can’t for whatever reason and you don’t want to spend the extra money because your finances just don’t support that, then go to Amazon, get a 27-dollar heat lamp and rub your head every night before you go to bed. Just to comfort. Don’t go crazy. But put it over your whole skull. Would you say that’s a fair summary of your years of research and what you’ve learned?

**LL:** When you use something at 10 watts, keep moving it.

**JM:** Oh yeah.

**LL:** It’s got quite a bit of power.

**JM:** The device I recommend has two settings. Imaging one is like half power. It’s 5 watts. The 5 watts you can pretty much keep on almost indefinitely in one spot and not be uncomfortable. But at 10 watts, you’re right, you do have to move it around, otherwise you will get some [discomfort]. But let your body guide you. Always listen to your body. Get the feedback. You know you won’t run into trouble.

If you use a 250-watt light bulb, you’ll get a lot more challenges. Because with the heat lamps, only 12 percent of the energy is near-infrared, the rest of it is mid-infrared, which is transferred as heat.

**LL:** Let me give you a clue. The moment you feel heat, just move it.

**JM:** Yeah. Right.

**LL:** You don’t want heat, actually, in photobiomodulation.
JM: Yeah. That is a very good clue. Just to let me finish this, that device I’m referring to is not for photobiomodulation. It’s sold as a device to help muscle pains. That’s what it’s used for. Okay?

LL: Actually, heat lamps are good for muscle pain.

JM: Would you say that it might be wise to go up a little bit higher if you have a muscle injury you’re trying to treat or is it the same thing? The moment you feel the heat, move it?

LL: Yeah. Actually, these are all pretty well-researched. When you have muscle pain or pain in certain parts of your body, you can direct low-level laser in that focal area. We have tested a lot of devices too. It is quite remarkable. Even systemic pain. But [when] you have like carpal tunnel syndrome or tennis elbow [and] you put low level laser, you’ll find that very often, within half an hour, the pain goes away.

If you go to the chiropractor’s office, a lot of them have these clinical devices with low level laser. Here’s the interesting thing that I found. Even in the tropics, people get the sun but they still have pain. There is something to say about directing something more focal in particular areas of the pain. When you direct basically a monochromatic wavelength that affects the mitochondria, that seems to work even when you have a lot sunlight. In a way, it’s complementary. If you’re in the sun often, you’re probably healthy and you’re probably tough as hell. But sometimes you need some help.

JM: There’s no question. But then you have this whole biphasic issue. Like I’ve got a 15-watt laser that’s typically used in many chiropractors’ office called the K-laser. But I’ve been having second thoughts about it in understanding this biphasic approach because it may be too much power. Most of the research is done with the low-level light therapy and very low power. If you get too much, it’s going to actually inhibit the improvement rather than stimulate improvement.

LL: Yeah. No one knows exactly where it starts to have the opposite effect. It all depends on the body. But you know it varies from person to person. But generally, if you can deliver low energy just enough for the cells to respond, you don’t need to go higher than that. That is my personal opinion.

JM: I love that. Actually, when I learned of your work and started reading your studies and information that you were publishing, it really catalyzed my thought in this process. It really reshaped it to the appreciation to just what you just said. You don’t have to be high. I mean you don’t have to go and beat it with sledgehammers. You just can massage it and tickle and push it a little bit. That’s all that it needs to push it to improve and stimulate its progress towards healing and health.

LL: Yeah.

JM: Alright. This has been fantastic. We are going to have Dr. Hamblin on. He’s the deep researcher. He’s been doing this for a very long time at Harvard. He will certainly complement the information that you shared with us today. I am deeply appreciative for the time, effort and energy
you’ve put together to provide a commercial device that’s available for this devastating neurological disease. It can help so many people.

It may seem like a lot, but for someone with this disease, it can radically reduce the total cost, because you’re looking at tens of thousands, in many cases 100,000 dollars a year in extra expenses that is not covered by insurance. It has to come out of someone’s pocket. Frequently, the pocket runs dry pretty quickly because that’s a big expense for most people. Then they’re left with this psychoemotional trauma of not being able to care for their parents who cared for them. It’s just so expensive. They just don’t have enough resources to do it.

This is a simple one. Combine it with the _Fat for Fuel_, which is coming out in May. I think we’ve got a powerful synergy that can do a lot to really hit this epidemic of chronic disease that’s affecting the brain.

**LL:** I just want to add that what we have is considered a low-risk general wellness device. We don’t make a particular claim, except that we’ve just done this study on Alzheimer’s so we can point to some of the evidence. For me, safety first.

**JM:** It’s a lot safer than a 15-watt laser. There’s virtually no risk. There might be something that we’ve figured out. Maybe you get a little agitated or something, but essentially, it’s simple light. The toxicity risk is incredibly low. It’s safer than any medication. There’s no question about it. I mean it’s even safer than water. Excess water can kill you.

Alright. Thank you again. I appreciate all your effort. We will look forward to upcoming reports from you in the future.

**LL:** Thank you for inviting me. It’s been a pleasure.

_[END]_