

The Benefits of Red Light and Near-Infrared Light Therapy

Analysis by [Dr. Joseph Mercola](#) ✓ Fact Checked

STORY AT-A-GLANCE

- › Red and near-infrared light are a subset of natural sunlight, which actually acts and has value as a nutrient
- › Red light and near-infrared light therapies are ways to get some of the benefits of natural sunlight. These therapies may be particularly beneficial for people who aren't getting enough natural sunlight exposure
- › Cytochrome c oxidase, photo receptors on your mitochondria, capture photons of red and near-infrared light. The most effective wavelengths that activate this system are in the 600 to 700 nanometer and the 800 to 1,000 nanometer ranges. In response to light photons, your mitochondria will produce energy more efficiently
- › Another mechanism of action is related to the benefits of hormesis and the transient spike in reactive oxygen species. That burst of reactive oxygen species creates a cascade of signaling effects that stimulate the NRF2 pathway and heat shock proteins
- › A third mechanism of action involves retrograde signaling and the modulation of gene expression. Red and near-infrared light therapy activates genes involved in cell repair, cell regeneration and cellular growth, depending on the tissue

This article was previously published March 21, 2021, and has been updated with new information.

In this interview, Ari Whitten, author of "The Ultimate Guide to Red Light Therapy," reviews the mechanics and basic benefits of red light and infrared light. Whitten, who

has a degree in kinesiology, exercise science and movement science, has studied natural health, fitness and nutrition for over 20 years. He's been a personal trainer, health coach and nutritionist for many years, and went on to do a Ph.D. program in clinical psychology.

Light as Nutrition

Red and near-infrared light are, of course, a subset of natural sunlight, which actually acts and has value as a nutrient. Red light and near-infrared light therapies are ways to get some of those benefits. It may be particularly valuable and beneficial for people who aren't getting enough natural sunlight exposure, and that's a majority of people. As noted by Whitten:

"There's a mountain of literature showing that regular sun exposure is one of the most powerful and important things you can do for your health and to prevent disease. Simultaneously, we have a general public that is afraid of sunlight.

Even the subject of melanoma is rife with misunderstanding because there is research showing, mechanistically, that if you expose cells in a Petri dish to lots of UV light, you can absolutely induce DNA damage and induce cancer formation.

You can take rats and expose them to tons of isolated UV light and induce cancer. You can even find an association between sun burns and increased melanoma risk.

Despite all of those things, it is also the case that when you compare people with regular sun exposure to people with much less sun exposure, they do not have higher rates of melanoma.

In fact, there's a bunch of studies comparing outdoor workers to indoor workers, showing that outdoor workers have lower rates of melanoma despite three to nine times more sun exposure."

One of the reasons for this is because indoor workers are exposed to fluorescent lighting, which is loaded with dirty electricity or high voltage transients that cause biological harm. So, not only do they not get sunlight exposure, but they also get harmful EMF exposure.

But the biggest factor has to do with the frequency of exposure. Intermittent exposure – occasional exposure followed by many days or weeks of little to no exposure – tends to be more problematic than regular, frequent sun exposure, as you're more likely to burn and cause DNA damage in your skin.

Regular exposure, on the other hand, ameliorates this risk, as it engages innate adaptive systems in your skin, your melanin in particular, that are explicitly designed to prevent DNA damage from UV light exposure.

"So, we have this system built into our bodies that's designed to allow us to get all these benefits of sunlight without the DNA damage and the increased skin cancer risk," Whitten says. "Framing light as a nutrient is the best way of understanding this."

Just as we require adequate nutrients from the food we eat, just as our bodies require physical movement to express normal cell function, we also require adequate light exposure to express normal cell function. The absence of that exposure to sunlight creates abnormal cell function. And there are myriad mechanisms through which this occurs.

Vitamin D is obviously the most well-known one that regulates over 2,000 genes related to immune health, musculoskeletal health and many other things. But there are many other mechanisms [as well]."

Bioactive Wavelengths

As explained by Whitten, there are specific bioactive wavelengths, and they work through different mechanisms. One mechanism is through your eyes, which is why you're typically better off not wearing sunglasses on a regular basis. When you're

outdoors on a sunny day, without sunglasses, blue and green wavelengths enter your eyeballs and feed through nerves into the circadian clock in your brain.

Your circadian clock, in turn, regulates a variety of bodily systems, from neurotransmitters involved in mood regulation to hormones involved in immune function. A dysregulated circadian rhythm has been linked to dozens of diseases, including cancer, cardiovascular disease and neurological diseases.

"I consider disrupted circadian rhythm and poor sleep to be probably the single most common cause of low energy levels and fatigue," Whitten says. Fatigue is the key focus of his Energy Blueprint brand, and in the interview, he reviews some of the other root causes for poor energy and fatigue, aside from light exposure.

In summary, your body's resilience, i.e., your ability to tolerate environmental stressors, is directly dependent on the robustness, both in terms of quantity and quality, of your mitochondria. When your resilience threshold is exceeded, disease processes are activated, and fatigue can be viewed as the initial universal symptom prior to overt disease. For more information about this side topic, be sure to listen to the interview or read through the transcript.

Red Light Therapy

Modern day red light and near-infrared light therapy is an extension of the original Helio therapy or sun-based therapy, which has a long and rich history of use for a number of diseases, including tuberculosis.

Over the past few decades, more than 5,000 studies have been published about red and near-infrared light therapy, aka, photobiomodulation, for a wide range of ailments, from combating wrinkles and cellulite to hair regrowth, sports performance, accelerated injury recovery, increased strength and much more.

"You get improvements in strength adaptations, improvements in muscle protein synthesis and the amount of muscle that's gained, amplified fat loss,

increased insulin sensitivity – all when combined with exercise, compared with exercise alone," Whitten says.

"There's also research on people with Hashimoto's hypothyroidism showing profound reductions in thyroid antibodies, as well as thyroid hormone levels. There are also hundreds of studies on random niche things like helping people with diabetic ulcers ... combating arthritis pain and chronic pain, joint health, tissue and bone healing ...

There are at least dozens, if not hundreds, of studies on using red light therapy in the context of people undergoing chemotherapy to combat oral mucositis, which is inflammation of the oral mucosa that happens as a side effect of some chemotherapy drugs. One of the most, if not the most, effective treatment for that is red light therapy."

There are also studies showing benefits for Alzheimer's and Parkinson's patients. The difficulty is getting the light to sufficiently penetrate the skull. According to Whitten, near-infrared at 800 to 900 nanometers will penetrate about 20% to 30% deeper than red wavelengths in the range of 600 to 700 nanometers.

"So, if you're trying to treat the brain, you need a pretty powerful device to be able to emit a strong enough beam of light to penetrate through the skull bone to actually deliver some of that light – which is a relatively small portion, probably less than 20% or something of the overall light being emitted – into the brain," he says.

More Is Not Necessarily Better

A common fallacy is that if something is beneficial, then the more the better. But this can be a hazardous assumption. As explained by Whitten, there is a biphasic dose response to red and near-infrared light therapy. Basically, you need to do enough of it to experience its effects, but if you overdo it, you can cause negative effects. So, it's all about finding the sweet spot.

That said, as a general rule, your risk of exceeding the beneficial dose with light therapy is lower than it is with something like exercise. Meaning, it's much easier to overdo exercise and end up with tissue damage from that than it is to overdo red and near-infrared light therapy.

"I interviewed Dr. Michael Hamblin, who's widely recognized as the world's top researcher on red and near-infrared light therapy, and I asked him explicitly about this biphasic dose response. I was actually pretty shocked by his response.

He kind of blew off the whole thing as not really significant, [saying] 'It's really hard to overdo it, and I'm not worried about really negative side effects from overdoing it.' Having said that, he is a researcher and he's doing things in a lab.

And what I've seen in my group of about 10,000 people that have gone through my program, many people with severe chronic fatigue or debilitating chronic fatigue syndrome, is there seems to be a small subset of people, I'm guessing somewhere between 1% and 5% of people, that have a really negative reaction to it, even at really, really small doses, let's say two minutes of red light therapy ...

So, there seems to be this small subset of people that is really hypersensitive and prone to negative effects. Generally, in my experience, those people are usually in very poor health overall."

One potential reason for this is because, like exercise and fasting, light therapy is a type of hormetic stress, which works in part by transiently increasing free radicals or reactive oxygen species.

People with extremely poor mitochondrial health will have a very low resilience threshold, so their capacity to tolerate that burst of reactive oxygen species will be low. At that point, they're simply creating damage, and their bodies don't have the resilience to effectively recover from it.

Mechanisms of Action

As noted by Whitten, there are several accepted mechanisms of action, and then there are more speculative mechanisms. One of the most well-known mechanism is cytochrome c oxidase, a photo receptor on your mitochondria that literally captures photons of red and near-infrared light.

“ Cytochrome c oxidase, photo receptors on your mitochondria, capture photons of red and near-infrared light. The most effective wavelengths that activate this system are in the 600 to 700 nanometer and the 800 to 1,000 nanometer ranges. In response to those light photons, your mitochondria will produce energy more efficiently.”

The most effective wavelengths that activate this system are in the 600 to 700 nanometer range, and the 800 to 1,000 nanometers range. In response to those light photons, your mitochondria will produce energy more efficiently. "In general, cells – whether it's skin cells, your thyroid gland, your muscle cells – they work better if mitochondria are producing more energy," Whitten explains.

This is one general principle of how light therapy can help heal such a diverse range of tissues and conditions. Another mechanism is related to the benefits of hormesis and the transient spike in reactive oxygen species. That burst of reactive oxygen species creates a cascade of signaling effects that stimulate the NRF2 pathway and heat shock proteins, for example.

As a result, your intracellular antioxidant response system is strengthened and your mitochondria are stimulated to grow bigger and stronger. It also stimulates mitochondrial biogenesis, the creation of new mitochondria. Ultimately, all of this increases your resistance to a broad range of environmental stressors.

"If hormesis is dosed properly, it should not create lasting harm. It should stress the system temporarily and stimulate adaptive mechanisms that ultimately make the whole system more resistant to any kind of harm," Whitten says. "But you shouldn't be doing hormesis at a dose that is actually creating damage."

Light Therapy Modulates Gene Expression

A third mechanism of action involves retrograde signaling and the modulation of gene expression. Your mitochondria play a key role here as well. As explained by Whitten:

"Mitochondria are not just mindless energy generators, but they are also environmental sensors that pick up on what's going on in the environment. Are there toxins present, is there a pathogen present? Is there increased inflammatory cells present?"

They're picking up on these signals. They're also picking up on light signals ... and reactive oxygen species from hormetic stress. And they're relaying these signals back to the mitochondria in a way that modulates gene expression."

There's a specific set of genes that are expressed in response to red and near-infrared light therapy. In summary, it activates genes involved in cell repair, cell regeneration and cellular growth, depending on the tissue.

For example, in your brain, it activates brain derived neurotrophic factor (BDNF), in your skin, it increases expression of fibroblasts that synthesize collagen, in your muscles, it locally increases expression of IGF1 and factors involved in muscle protein synthesis. "So, you're getting these local effects in those specific tissues that upregulates genes involved in cell healing, growth and repair," Whitten says.

Exposure to UVA, red light and near-infrared light also increases the release of nitric oxide (NO) which, while being a free radical, also has many metabolic benefits in optimal concentrations. Many of the benefits of sun exposure cannot be explained solely through the production of vitamin D, and the influence of NO may be part of the answer.

There's also a speculative line of research suggesting that red and near-infrared light interact with chlorophyll metabolites in a way that helps recycle ubiquinol from ubiquinone (the reduced version of CoQ10).

So, those specific wavelengths of light may help recycle reduced CoQ10, which also enhances energy production. "So, there may be this really interesting synergy between your diet and red and near-infrared light therapy were consuming more chlorophyll-rich compounds may enhance this effect," Whitten says.

Light Structures Water

Yet another mechanism of action has to do with the structuring the water that surrounds your cells. One of the best ways to build this structured water is through exposure to sunlight. Simply drinking structured water is ineffective. Whitten explains:

"The structuring of water is a really fascinating layer of the story. There's research showing that the water near membranes, and our mitochondria are composed of membranes, can actually change in viscosity in response to red and near-infrared light therapy.

There are a couple things that happen there. One is that reduced viscosity actually helps the physical rotation of the ATPAs, the ATP synthase pump on the mitochondria, which is the last part of the respiratory chain in mitochondria that creates ATP molecules. That's a physical rotary mechanism.

So, you have this rotary pump that needs to move in water, and there's some research suggesting that it moves more efficiently with less resistance when the viscosity of that surrounding water is reduced, and that this may, at least partly, be responsible for the enhanced energy production.

But there's one other layer to the story. I've dug really deep into the literature on light and deuterium. It was tough to find any literature on this, but I did find one really interesting study. Basically, what they found is that, when the viscosity of this water around the mitochondrial membranes is reduced, it does two things.

It pushes the deuterium molecules – which is this isotope of hydrogen that tends to damage mitochondria – away from the mitochondria and makes it less likely to go through the mitochondrial ATP synthase pump where it can create damage.

It also enhances the movement of hydrogen ions – normal hydrogen not deuterium – across the membrane, so more hydrogen can move faster and more efficiently through the mitochondria, whereas deuterium moves less efficiently.

So, it doesn't necessarily deplete deuterium from your body ... but it almost mimics deuterium depletion in a way by making the deuterium much less likely to actually get into the mitochondria where it would create damage."

On Saunas

We cover far more in this 1.5-hour interview than I've summarized here, so for more information, be sure to listen to the interview in its entirety. For example, we delve into the benefits of sauna bathing and the hormetic response to heat stress, which helps repair misfolded proteins.

We also discuss the different types of saunas, the problem posed by electromagnetic fields and why most near-infrared saunas really aren't. As a quick summary review, there are no pure near-infrared saunas, as part of the near-infrared spectrum is non-heating. Incandescent heat lamps, which is what most people are referring to when talking about near-infrared saunas, emit mostly mid- and far-infrared.

Only about 14% of that light is in the near-infrared spectrum. That said, these kinds of incandescent heat lamps could potentially still deliver a therapeutic dose if you use them for about 20 minutes.

"Let's frame it this way," Whitten says. "If you have a heat a near-infrared style sauna, a heat lamp style sauna, where you're sitting in a chamber that is 110 degrees to 120 degrees Fahrenheit, you cannot claim that it has the same

benefits of a sauna when the research on sauna uses sauna chambers that are massively hotter than 110 to 120 degrees. They're using temperatures of 170 to 220 degrees.

So, if it's 100 degrees less, you can't just say it has all the benefits of saunas. Maybe it does have the same benefits, or maybe it has some of the benefits, or maybe it even has superior benefits. But all of those are speculative claims that you can't make until you've done the studies ...

We know, for example, that in animal studies, heat stress extends lifespan. It stimulates all kinds of mechanisms that are involved in longevity, autophagy, increased resilience via these hormetic pathways. And in general, when it comes to hormesis, I believe you do need to get a bit uncomfortable.

It should be something that pushes you into your edge of discomfort. And my experience with the heat lamp style sauna is that by themselves, these 110-, 120-degree F chambers, don't really push the edge of discomfort apart from maybe the local area that's being exposed to the light from the heat lamps."

One way to get around this and eliminate the EMF problem, is to preheat your far-infrared sauna as high as it'll go, then turn it off and turn on your near-infrared bulbs. As for benefits, heat stress is known to:

- Preserve muscle mass and prevent the loss of muscle if you're unable to exercise for a period of time
- Lower your risk of infections
- Improve detoxification
- Reduce your risk of depression, cardiovascular and neurological disease
- Reduce all-cause mortality

More Information

To learn more, be sure to pick up a copy of Whitten's book, "[The Ultimate Guide to Red Light Therapy](#)." On his website, [TheEnergyBlueprint.com](#), you can also access his [Energy Blueprint podcast](#), articles, programs and testimonials.

In his book, Whitten provides specific recommendations for red- and near-infrared therapeutic devices, which can save you a lot of research time if you're considering this kind of therapy. As noted by Whitten:

"There are a few good brands. It really matters what device you get. I want to put this caution out there because there are a lot of junk devices. There are a lot of devices that are one-fiftieth the power output of the devices that I recommend, and somebody who isn't savvy to that, isn't knowledgeable about why the power output of these devices matters, might just go on Amazon and buy some \$30 device.

If you get an underpowered device, you're not doing the same red light therapy, or near-infrared light therapy as [when you're using] a real high-powered device. So, it is very important to do this the right way, to get the right quality device and to dose it the right way."