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Take Control of Your Health

The Role of Sun Exposure in Optimizing Your Cellular Health

Analysis by Dr. Joseph Mercola | May 11, 2025

STORY AT-A-GLANCE

- Just like plants, you need sunlight to thrive, as there's a biological mechanism in your body that transforms sunlight into cellular energy
- When the sun's rays touch your skin, your body captures the red and near-infrared light and converts them into electrons. Your body then uses these electrons to feed the electron transport chain and create ATP in your mitochondria
- Reductive stress is a biological mechanism that could be hampering your ability to create sufficient cellular energy. If going out in the sun makes you feel worse, you may need to first resolve reductive stress in your body
- Grounding to the earth and using methylene blue can help get rid of the excessive electrons that have accumulated in your mitochondria. However, it is crucial to address the root causes of reductive stress
- Beyond vitamin D production, sunlight exposure helps optimize melatonin production and anchors the circadian rhythm for better sleep, making it a crucial but underrated factor in overall health maintenance

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The role of sun exposure for your well-being is a topic that's close to my heart, and for more than two decades it's one of the top recommendations that I stand firm on. One of the benefits, of course, is that it allows you to optimize your vitamin D levels — however, the benefits far surpass that, as it actually awakens the essence of your biology.

In this podcast, I go into the details on why getting optimal sun exposure is one of the cornerstones of health, particularly the role it plays in optimizing your cellular energy. I encourage you to listen to it in its entirety as it will help you understand this groundbreaking information that will help you reach optimal health.

Just Like Plants, You Cannot Thrive Without Sunlight

There's no question that the sun powers every form of life on the planet. Plants, for example, cannot survive without sunlight, as they need it for photosynthesis. When the sun's rays shine on a plant, the electrons in the chloroplasts, a sac-like organelle that contains chlorophyll molecules, convert the solar energy to structural energy in the form of glucose. This then fuels the biological processes in the plant.

You, on the other hand, mostly rely on the foods you eat as an energy source. Take note that I said "mostly," because did you know that you also have the capacity to use sunlight to produce cellular energy?

In low light, a plant can survive for a time. However, it will not thrive — its leaves will not become green and lush, it will not produce beautiful flowers and its growth will be stunted. The same can happen to humans. You cannot reach your full health potential unless you're getting regular sun exposure.

There is one caveat to this, however. If you've been eating a diet high in vegetable oils or seed oils, you need to approach sun exposure with caution, as these oils increase your risk of sunburn. That's why I recommend avoiding high-intensity sun exposure unless you've been off these oils for at least four to six months. I'll explain why further below.

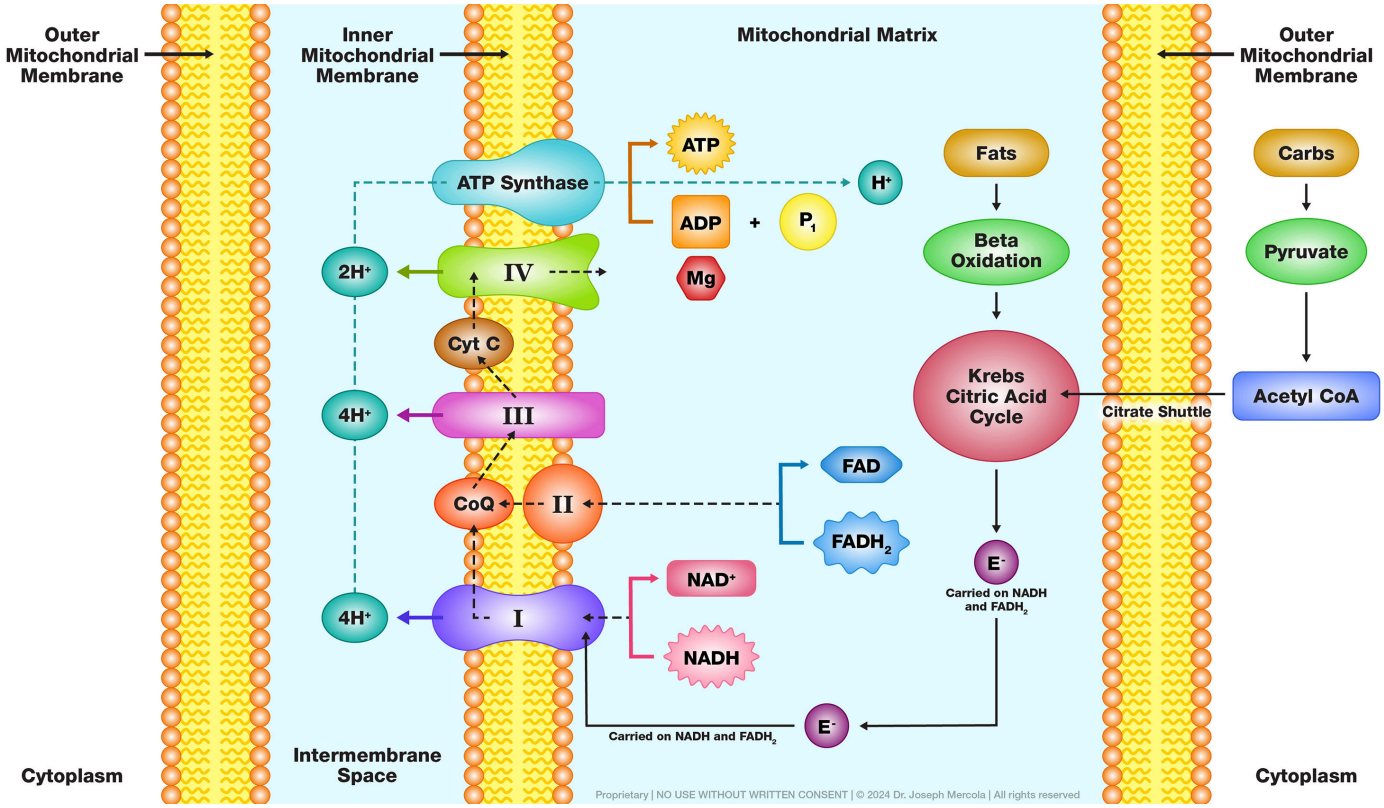
Sunlight Is the Unrecognized Nutrient You Cannot Live Without

Just like plants, you need sunlight to thrive, as there's a biological mechanism in your body that transforms sunlight into cellular energy. I'm actually in the process of doing some experiments and have set up a mitochondrial research lab to study this theory more closely.

But basically, here's how it works — your body, when exposed to the sun, collects electrons from solar energy that are used for mitochondrial energy production. This is why failing to get enough sun exposure can have severe consequences for your health.

Your body primarily gets its energy from the foods you eat. When you digest food in your intestine, it is ultimately metabolized to tiny molecules called acetyl-Coenzyme A.

As acetyl-Coenzyme A enters the mitochondria and goes through the Krebs cycle, it is converted into electrons, which are then carried by NADH and FADH2 into the electron transport chain (ETC). This final stage of cellular respiration is where the electrons are transformed by your body into adenosine triphosphate (ATP) — the fuel on which your body runs. To help you understand, here's an illustration of how cellular energy is created.



Your Cellular Health Also Relies on Sun Exposure

In the case of sun exposure, when the sun's rays touch your skin, your body captures the red and near-infrared light and converts them into electrons. Your body then uses these

electrons to feed the ETC and create ATP in your mitochondria.

A single electron transport chain can produce 100 ATPs per second. Considering that every single mitochondrion contains 100,000 electron chains, that means you're producing 10 million ATP molecules per second.

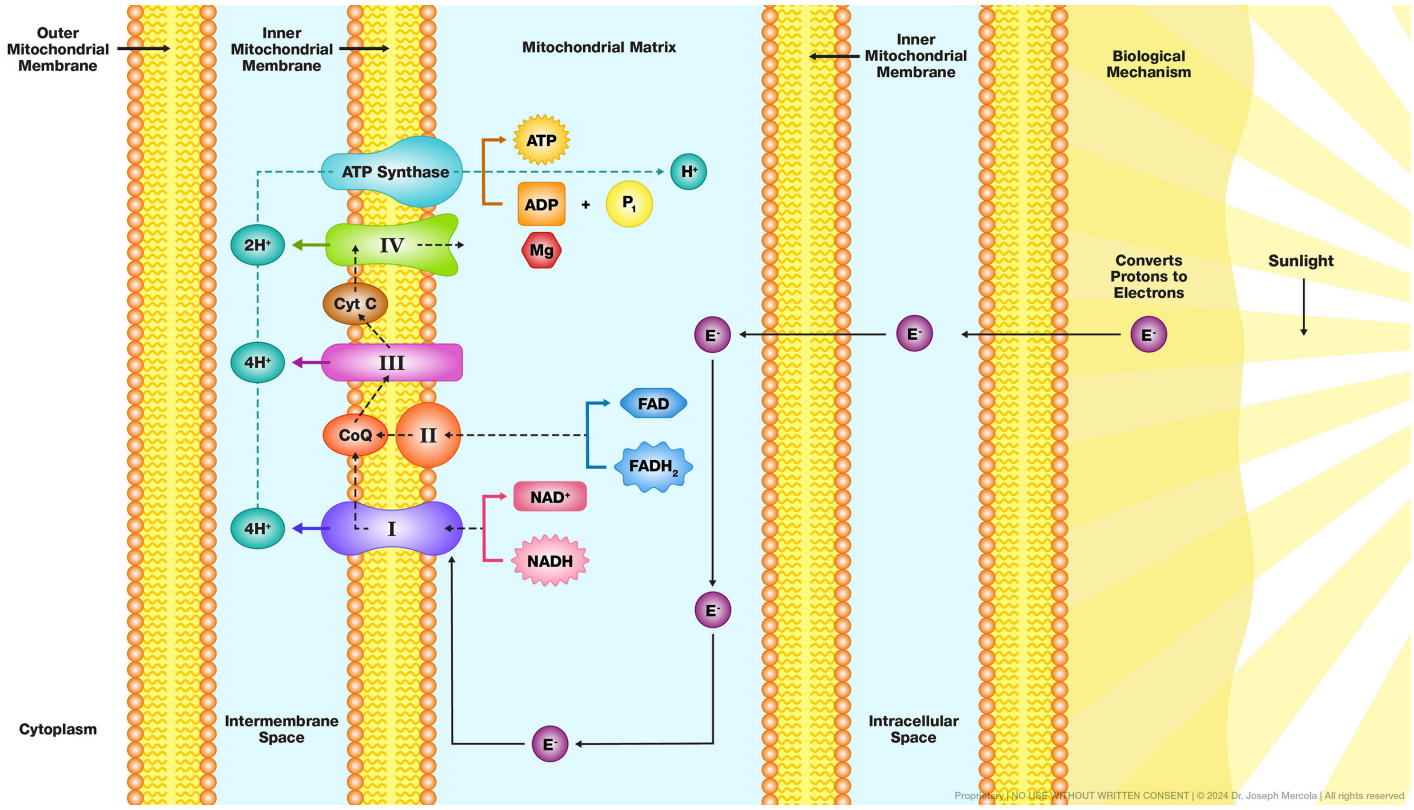
And when you multiply that by 40 quadrillion — that's the number of mitochondria you have in your body — that means you're producing 400 million quadrillion ATPs per second.

If you're optimally healthy, then typically you're producing enough ATP per day to fuel all the cellular functions of your entire body. But if you're not creating enough ATPs, then you won't have enough cellular energy for all processes. The result? Some "nonessential" processes are then downregulated to conserve energy. The available fuel goes to essential life-preserving processes and little else.

Not only will you feel miserable and experience fatigue as a result of this, but it will also put you at high-risk of basically every chronic degenerative disease known to man today, including cancer, diabetes and heart disease. That's why I call this my unified theory of cellular health.

This is why you need sunlight. Although it follows a different yet equally complex series of steps as when you use energy from food, it ultimately leads to the same result — the transfer of electrons into the ETC of your mitochondria, which boosts your cellular health.

To help you better understand the difference between how your body creates cellular energy from your food versus from the sun and the complex steps involved, I created the 2-D illustration below.



Most People Hide from the Sun

Getting enough sun exposure is one of the most beneficial yet underrated strategies to help achieve optimal health. Apart from exposing you to beneficial red and near-infrared light that contributes to cellular energy production and other health benefits, it also helps optimize your vitamin D levels and melatonin production, which helps anchor your circadian rhythm to help you better sleep at night.

Unfortunately, a significant portion of the population isn't getting enough sun exposure. According to a survey published in Medium,[1] 58.8% of Americans say they spend one hour or less outdoors daily, while one-third are only getting 30 minutes of outdoor time, or less. Women and young adults in particular spend more time indoors.

The Keys to Safer Sun Exposure

There's no doubt that spending time outdoors in bright sunlight is one of the fundamental strategies to regain and maintain your health, so whenever you have an

opportunity to go outdoors, do it. It is really important for you to get your one hour of sun exposure around solar noon (12 noon, or 1 p.m. during daylight saving time) to reap the maximum solar benefits.

Wear as little clothing as possible to expose large areas of your skin. Consider doing outdoor activities as well, such as walking or engaging in a regular exercise routine. However, as mentioned earlier, it's important to avoid high-intensity sun exposure until you've been off seed oils for about six months, as these oils significantly raise your risk of sunburn.

These oils are rich in linoleic acid (LA), an omega-6 fat that is highly prone to oxidation when exposed to ultraviolet (UV) radiation. When sunlight interacts with skin containing these oils, it causes the oils to break down, leading to inflammation and DNA damage.

So, while you're reducing vegetable oils in your diet, temporarily avoid peak sunlight hours, which are typically an hour before and after solar noon. In most of the U.S. during summer, this means staying out of direct sun from 11 a.m. to 3 p.m. during Daylight Saving Time, or 10 a.m. to 2 p.m. in Standard Time.

Over time, as your body detoxes the accumulated seed oils, you can gradually increase your time in the sun. Eventually, you will be able to enjoy an hour or more of peak sunlight hours.

The Importance of Addressing Reductive Stress

I've been practicing medicine for four decades now, and back when I still used to see patients, I've encountered those who say that when they go out in the sun, they end up feeling worse, as if their body is warning them to stop doing what they're doing and get out of the sun.

The fact is that your body will never lie to you. If it's telling you to get out of the sun, then there could be something else you need to pay attention to. So, if you experience this paradox, then it boils down to resolving reductive stress — this biological mechanism could be hampering your ability to create sufficient cellular energy.

Reductive stress, to put it simply, means you have too many electrons backed up in your electron transport chain in your mitochondria. In my interview with molecular biologist Brad Marshall, he explains:

> *"The calories in food are just electrons between the carbon and the hydrocarbon bonds … Those electrons between the carbon and the hydrogen, that's where the energy is. And so, we have these systems where the electrons flow through the cell, and we use that electron flow to create ATP, and the ATP moves our body.*
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> *The electrons move on electron carriers, which are things like NAD. NAD, when it has electrons, is NADH, and when it loses the electrons, it's NAD+. You want a balance of NAD+ and NADH. Then the electron flow works.*
>
> *What happens is, we get too many electrons in the system. We get too many NADH and not enough NAD+. And that can happen because we're allowing too much fuel into the system. That's usually why it happens. To use an analogy, cars used to have carburetors. A carburetor takes in fuel and air and mixes the fuel and the air together."*

When there's a surplus of electrons in your body, it can clog up the series of complexes that are occurring in your electron transport chain. Think of it like pouring a liquid from a big bottle into a small funnel — if there's too much and you pour too quickly, it will overflow and spill, becoming unusable.

Reductive stress can cause damage, as the surplus of electrons prevent the ETC from transferring them down to Complex IV and they prematurely combine with oxygen to create reactive oxygen species.

Reductive stress also slows down your metabolism and energy production. It's like your body's systems are overwhelmed with energy they can't properly use, which leads to decreased efficiency and damage over time. Molecular biology can be complicated, so I encourage you to **watch my interview** with Marshall to get a better understanding of this topic.

Grounding Can Help Address Reductive Stress

Addressing reductive stress means getting rid of the excess electrons that have accumulated in your mitochondria as a result of your inability to create sufficient cellular energy. Fortunately, there are two methods you can use that I highly recommend. One is being connected to the earth.

Have you ever tried walking on a carpet in a low-humidity environment, such as during a cold winter morning, then touching a metal doorknob? You'll get an electric shock. But contrary to common belief, it's not the electrons coming from the doorknob into your hand; rather, it's the other way around.

The reductive stress that you built out is grounded to that doorknob because the humidity is low and not acting as an insulation. So, when your finger connects to the metal, you discharge the electrons as a spark. This can be surprising, but it's a good thing, as you're releasing your surplus of electrons and not slowing down your mitochondrial energy production.

Another way for you to release your surplus of electrons is by grounding — this is basically being electrically reconnected to the earth's surface. You can do this by walking barefoot, lying on the ground or being submerged in water.

However, if you live in North America, as I do, then grounding may not do you much good, as you're being exposed to "dirty electricity" brought about by distortions of high voltage transients in the electricity supplied to homes and buildings. Modern electronic devices are the main reason why these distortions occur. So, if you do grounding, you may discharge your surplus of electrons but you're also gaining unhealthy frequencies from the earth.

There are a couple of exceptions, though — if you live in a really remote area and if you ground to the ocean. In mountain areas where there's no power and the nearest substation is miles away, the ground is most likely healthy and you can connect to the earth there.

As for the ocean, it is such a massive sink that it will accept those electrons. Aside from having salt, which is a good conductor, it gives you a continuous and stable connection to the Earth's natural electrical state, allowing an efficient transfer of surplus electrons in your ETC back to the Earth.

Using Methylene Blue

I don't particularly recommend resorting to drugs, but I believe methylene blue, said to be the oldest drug in existence today, can be a great alternative to grounding in helping you create enough cellular energy. Developed in 1876 by German chemist Heinrich Caro,[2] it is the first synthesized drug and has a rich history as both a dye and drug — in the textile industry, it is used as a dye for blue jeans.

When scientists discovered its medical properties, it became the first synthetic compound to be used as a drug, and was used to treat malaria, methemoglobinemia (a condition where hemoglobin cannot release oxygen effectively to body tissues) and as an antidote to cyanide poisoning.

This medicine has powerful metabolic effects, and in reductive stress, it can provide benefits by acting as a powerful electron acceptor that temporarily removes the bottleneck created by faulty metabolism so it can function again and continue producing cellular energy. If there's a block anywhere in the electron transport chain, methylene blue simply transfers the electrons straight to oxygen, bypassing the obstruction.

The only concern about methylene blue is you need to a prescription to purchase it. For human use, the safest option is pharmaceutical grade methylene blue, for which you need a prescription.

Never use industrial grade methylene blue (which is often used for cleaning fish tanks), as it is frequently contaminated with heavy metals. Instead, have your physician write you a prescription to a compounding pharmacy. One of the better ones I have found is **Town & Country compounding pharmacy**.

These compounded pills can easily be made into 50 milligram capsules, but since you only need 5 mg once a day, one 50 mg pill can be enough for 10 doses. Take a 50-milligram pill (be careful when opening it, as the dye can stain your hands and countertop) and put it into 50 cubic centimeters (cc) of water, or just under 2 ounces.

Measure out 5 cc, which would be about a tablespoon, and then save the rest. If you are using it to optimize the benefits of sun exposure, it is best to take it approximately 30 minutes before going out into the sun.

Get to the Root Cause of Reductive Stress

All of that said, when it comes to optimizing your cellular health, I advise going to the root cause instead of just relying on methylene blue and grounding. Although helpful, you cannot achieve your body's full potential if you do not address your **excessive LA intake**, optimize your gut microbiome, lower your estrogen burden and get rid of EMFs.

These four key culprits wreak havoc on your mitochondrial function, so addressing them is a crucial step to successfully bring back your cellular health. Once you've taken control of these four factors, your body will start to recover, repair and regenerate, and you'll regain the ability to increase your mitochondrial function and the ability to increase cellular energy.

I urge you to listen to this podcast until the end. You may need to listen to it several times to fully grasp these complex processes, as they can be quite complicated — it took me almost 50 years to fully comprehend these concepts, but I guarantee that once you implement them, you will be far closer to taking control of your health.

Sources and References

- [1] Medium, June 30, 2022
- [2] D J Med Sci 2020;6(3):136-145 (PDF)