

Strategies to Optimize Mitochondrial Health in Long COVID

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STORY AT-A-GLANCE

- › Mitochondrial dysfunction is at the root of most all chronic diseases, and it also plays a crucial role in conditions such as long COVID, which is becoming quite common. It's also a root factor that must be addressed in COVID job injuries, regardless of symptoms or severity
- › One of the most foundational lifestyle components that can make or break your mitochondrial health is electromagnetic field (EMF) exposure. To allow your body to heal, you'll want to minimize EMF exposure as much as possible
- › The cristae of the inner membrane of the mitochondria contains a fat called cardiolipin, the function of which is dependent on the type of fat you get from your diet. Cardiolipin is important because, if cardiolipin is damaged, mitochondrial energy production will be impaired. The most damaging fat is omega-6 linoleic acid, found in seed oils
- › Another major culprit that destroys mitochondrial function is excess iron, and almost everyone has too much iron. Copper is also important for energy metabolism, detoxification and mitochondrial function, and copper deficiency is common. Copper is also required for proper iron recycling, and low ferritin is typically a sign of copper insufficiency
- › Other strategies reviewed include sun exposure and near-infrared light therapy, time-restricted eating, NAD+ optimizers and methylene blue, which can be a valuable rescue remedy

The video above features a recent lecture I gave to the American College for Advancement in Medicine (ACAM) on how to optimize your mitochondrial health and function.

Mitochondrial dysfunction is at the root of most all chronic diseases, and it also plays a crucial role in conditions such as long COVID, which is becoming quite common. It's also a root factor that must be addressed in COVID job injuries, regardless of symptoms or severity.

Features of the post-job injuries we see point to severe mitochondrial dysfunction, which in turn causes energy failure. The same goes for long COVID in people who struggle with unrelenting fatigue and other symptoms for months after they've recovered from COVID-19 infection.

If you can improve your mitochondrial function and restore energy supply to your cells, you're going to massively increase your odds of reversing the problems caused by the job or the virus.

US Life Expectancy Falls in Historic Decline

Allopathic medicine has been a leading cause of death in the U.S. for over two decades. In 1998, researchers concluded that properly prescribed and correctly taken pharmaceutical drugs were the fourth leading cause of death in the U.S.

Two years later, in 2000, Dr. Barbara Starfield published her groundbreaking paper, "Is US Health Really the Best in the World?"¹ in which she provided data showing that medical errors by doctors were the third leading cause of death. Little has changed since then.

In 2016, Johns Hopkins patient safety experts calculated that more than 250,000 patients died each year from medical errors, again pegging it as the third leading cause of death.²

In July 2022, the National Institutes of Health concluded the annual death toll from medical errors could be as high as 440,000 – and possibly even more because of lack

of reporting – making it, still, the third leading cause of death.³

In future years, I believe the medical intervention sold as "COVID vaccines" will prove to be the No. 1 killer of Americans, and we're already seeing that trend. Something extraordinarily odd happened in 2020 and 2021, something that shaved nearly three years off the life expectancy in the U.S.⁴

Even a tenth or two-tenths of a year mean decline in life expectancy on a population level is a big deal, as it means a lot more people are dying prematurely than they really should be. A three-year drop is simply unheard of.

While media blame this drop on COVID-19 infection, that makes no sense because the average age of those who died from COVID was about 85, well over the life expectancy in 2019. No, this massive drop in life expectancy is due to younger people dying decades earlier than they should, and the only factor that can account for that is the mass injection of people with an experimental bioweapon.

Limit Your EMF Exposure

One of the most foundational lifestyle components that can make or break your mitochondrial health is electromagnetic field (EMF) exposure. To allow your body to heal, you'll want to minimize EMF exposure as much as possible. The World Health Organization classified cell phone radiation as a 2B carcinogen in May 2011.

However, as I detail in my 2020 book, "EMF*D," it's actually a Class 2A carcinogen. To minimize your EMF exposure, which includes electric fields, magnetic fields and radiofrequencies:

- Keep your cell phone in airplane mode whenever you're not actively using it
- Do not sleep with it near your bed
- At night, be sure to turn off your Wi-Fi
- Turn the breakers off to your bedroom, as the electrical wiring in most homes also emit dirty electricity

- Alternatively, sleep in an EMF-shielding tent, which is what I use whenever I travel and have no control over the EMF exposure in my room

Dietary Fat Choices Influence Energy Production

You have about 40 quadrillion to 100 quadrillion mitochondria throughout the cells of your body. In my lecture, I show a picture of the structure of your mitochondria. The cristae of the inner membrane of the mitochondria contains a fat called cardiolipin,⁵ the function of which is dependent on the type of fat you get from your diet.

Cardiolipin is important, because it influences the structure of the cristae inside your mitochondria, which is the area where energy production occurs. If cardiolipin is damaged, then the complexes will not be close enough together to form supercomplexes and thus the mitochondrial energy production will be impaired.

Cardiolipin also works like a cellular alarm system that triggers apoptosis (cell death) by signaling caspase-3 when something goes wrong with the cell. If the cardiolipin is damaged from oxidative stress due to having too much LA, it cannot signal caspase-3, and hence apoptosis does not occur. As a result, dysfunctional cells are allowed to continue to grow, which can turn into a cancerous cell.

The type of dietary fat that promotes healthy cardiolipin is omega-3 fat, and the type that destroys it is omega-6, especially linoleic acid (LA), which is highly susceptible to oxidation. So, to optimize your mitochondrial function, you want to avoid LA as much as possible, and increase your intake of omega-3s.

Primary sources of LA include seed oils used in cooking, processed foods and restaurant foods made with seed oils, condiments, seeds and nuts, most olive oils and avocado oils (due to the high prevalence of adulteration with cheaper seed oils), and animal foods raised on grains such as conventional chicken and pork.

Ideally, consider cutting LA down to below 7 grams per day, which is close to what our ancestors used to get. If you're not sure how much you're eating, enter your food intake

into [Cronometer](#) – a free online nutrition tracker – and it will provide you with your total LA intake.

Cronometer will tell you how much omega-6 you're getting from your food down to the tenth of a gram, and you can assume 90% of that is LA. Anything over 10 grams of LA is likely to cause problems. Healthy fat replacements include tallow, butter or ghee, all of which are excellent for cooking.

Address Iron Excess and Copper Insufficiency

Another major culprit that destroys mitochondrial function is excess iron, and almost everyone, with the exception of menstruating women and those with large blood losses, have too much iron. On the other side of this coin is copper, which most people are deficient in.

Iron and copper are highly interdependent and need to be considered together. Low ferritin is rarely indicative of low iron. In most cases, it's a sign that copper insufficiency is preventing proper iron recycling. Copper is also crucial for energy metabolism, detoxification and mitochondrial function.⁶ You can learn more about this in "[The Poorly-Understood Role of Copper in Anemia.](#)"

To increase your copper level, you can either take 4 to 10 milligrams of copper bisglycinate per day, or eat more copper-rich foods, such as bee pollen, grass fed beef liver and acerola cherry. (Acerola cherry is very high in vitamin C, which contains the copper-rich tyrosinase enzyme.)

The other side of the equation is to lower your iron, which is easily done through regular blood donations. One way is to simply donate blood two to four times a year. If losing 10% of your blood in one sitting is problematic, then you can remove blood in smaller amounts once a month on the schedule I have listed below. If you have congestive heart failure or severe COPD, you should discuss this with your doctor, but otherwise this is a fairly appropriate recommendation for most.

Men	150 ml
Postmenopausal Women	100 ml
Premenopausal Women	50 ml

The Importance of Sun Exposure

A third leading contributor to mitochondrial dysfunction is lack of sun exposure. Getting regular sun exposure is crucial for several different reasons:

1. UVB triggers vitamin D production in your skin – In addition to playing an important role in infections, vitamin D is also necessary for mitochondrial function and cell health in general.^{7,8} The ideal source of vitamin D is sun exposure, so if you live in an area with plenty of year-round sunshine, aim to expose as much bare skin as possible for about an hour during solar noon.

If you live in an area that doesn't get enough sunshine during parts of the year, you'll want to take a vitamin D3 supplement, along with magnesium and vitamin K2.

You need 244% more oral vitamin D if you're not also taking magnesium and vitamin K2,⁹ so taking them together means you need far less vitamin D in order to achieve a healthy vitamin D level, which is between 60 ng/mL and 80 ng/mL (150 nmol/L to 200 nmol/L).

2. Near-infrared rays in sunlight shining on your bare skin trigger melatonin production in your mitochondria¹⁰ – The vast majority of the melatonin your body produces (95%) is made inside your mitochondria in response to near-infrared radiation from the sun. Only 5% of melatonin is produced in your pineal gland.

Melatonin is a master hormone,¹¹ a potent antioxidant¹² and antioxidant recycler,¹³ a master regulator of inflammation and cell death,¹⁴ and an important anticancer molecule.¹⁵

Melatonin has also been shown to be an important part of COVID treatment, reducing incidence of thrombosis and sepsis¹⁶ and lowering mortality,^{17,18} and is a known cytoprotector with neuroprotective properties that can potentially reduce the neurological sequelae documented in patients infected with COVID-19.¹⁹

When your mitochondria produce ATP (the energy currency of your cells), reactive oxygen species (ROS) are created as a byproduct. ROS are responsible for oxidative stress, and excessive amounts of ROS will damage your mitochondria, contributing to suboptimal health, inflammation and thrombosis (blood clots).

Melatonin production in your mitochondria is your body's built-in mechanism to counteract this damage, but in order for this invaluable system to work, you must expose your body to near-infrared light. While you can raise your vitamin D level using a supplement, this cannot be done with melatonin.

Oral melatonin supplements do not wind up in your mitochondria where they are needed most to quench the damage from oxidative stress produced in the electron transport chain. An alternative to sun exposure would be to use a near-infrared sauna, described in "[Near-Infrared Sauna Therapy – A Key Biohack for Health.](#)"

3. Near-infrared light also:

- a. Increases mitochondrial ATP production
- b. Increases autophagy
- c. Increases heat shock proteins, which help proteins maintain their three-dimensional structure and refold misfolded proteins
- d. Reduces inflammation
- e. Triggers the conversion of retinol (vitamin A) to retinoids, which are crucial for immune function
- f. Structures the water in your body – Structured water acts like a storage battery that stores energy in your body in your blood, and helps push blood cells through your capillaries

Restore Metabolic Function With Time-Restricted Eating

The vast majority of people eat across 12 hours or more, which is a recipe for metabolic disaster. Health statistics bear this out. In July 2022, the Journal of the American College of Cardiology²⁰ posted an update on the metabolic fitness or flexibility of the American population.

Metabolic fitness includes things like blood glucose and blood sugar, blood pressure and weight, and metabolic flexibility refers to your body's ability to seamlessly transition between burning fat and carbohydrates as your primary fuel.

“ TRE is one of the easiest yet most powerful interventions for restoring metabolic flexibility and optimizing your mitochondrial function, which is key for recovery from any illness or disease.”

In 2016, 12.2% of Americans were considered metabolically fit.²¹ Two years later, in 2018, only 6.8% of U.S. adults had optimal cardiometabolic health.²² That was four years ago so, today, that ratio is probably even lower, especially if you consider the number of people who are now struggling with mitochondrial dysfunction as a result of the COVID jab.

TRE is one of the easiest yet most powerful interventions for restoring metabolic flexibility and optimizing your mitochondrial function, which is key for recovery from any illness or disease.

As a general rule, I recommend compressing your eating window to between six and eight hours, and fasting for the remaining 14 to 16 hours each day. The timing of that eating window is important though.

You want to avoid eating first thing in the morning (wait at least two or three hours) and you want to avoid eating right before bed. Ideally, have your last meal at least three

hours or more before bedtime. So, to give you an example, you could eat all your meals between 10 a.m. and 6 p.m., or 11 a.m. and 5 p.m.

Optimize NAD+

Boosting nicotinamide adenine dinucleotide (NAD+) is, I believe, another crucial component when treating COVID job injuries and long COVID. NAD+ is a crucial signaling molecule believed to play an important role in mitochondrial function and longevity.

NAD is used up by DNA repair enzymes and enzymes involved in inflammation and immunity, such that chronic inflammation or acute illness can rapidly result in depletion. To learn more about the role of NAD+ in health, see my interview with Nichola Conlon, Ph.D., a molecular biologist, featured in "[The Crucial Role of NAD+ in Optimal Health](#)." There are a number of ways to boost NAD+ without resorting to expensive supplements, including:

- Circadian rhythm optimization
- TRE and other forms of intermittent fasting
- [Low-dose niacinamide](#) (not niacin), taken at a dose of 50 mg three times a day. More is not better as it will impair the function of your longevity proteins (sirtuins)
- Intense exercise in a fasted state

Mitochondrial Rescuer: Methylene Blue

Methylene blue can be particularly useful for addressing the fatigue and neurological problems that are common in long COVID and COVID job injuries, as it works as an electron cyler. It basically acts like a battery, but unlike other compounds that do the same thing, it doesn't cause damaging oxidation in the process.

If anything interferes with oxygenation or cellular respiration, methylene blue is able to bypass that point of interference through electron cycling, thus allowing mitochondrial respiration, oxygen consumption and energy production to function as it normally would.

Methylene blue can also be helpful in instances where you have impaired blood flow that prevents the delivery of oxygenated hemoglobin to the tissues. In this case, methylene blue helps counteract the reduced blood flow by optimizing the efficiency of mitochondrial respiration.

Methylene blue also activates the Nrf2 pathway. Nrf2 is a transcription factor that, when activated, goes into the cell's nucleus and binds to the antioxidant response element (AREs) in the DNA. It then induces the transcription of further cytoprotective enzymes such as glutathione, superoxide dismutase catalase, glutathione peroxidase, phase II enzymes, heme-1 oxygenase and many others.

Methylene blue's action on mitochondrial respiration is also coupled with biochemical upregulation of your oxygen consumption machinery in general. This upregulation remains even after the methylene blue is expelled from your system, and over time, it can actually increase the number of mitochondria.

For neurological conditions, consider using methylene blue in combination with near-infrared sauna therapy. A 2020 paper²³ in *Translational Neurodegeneration* reviews the benefits of this combination, specifically as it refers to neuroprotection.

Methylene Blue Dosages and Quality Considerations

Methylene blue is a hormetic, so low dosages have the opposite effect of high dosages. While every possible dose response has not been tested, as a general guideline, the benefits mentioned here are based on lower dosages, ranging from 0.5 mg per kilogram of bodyweight to 4 mg per kg at most. For brain health and nootropic effects, a dosage between 0.5 mg to 1 mg per kg per day is recommended.

Selecting the correct product is of crucial importance. There are three basic types of methylene blue: industrial, chemical and pharmaceutical-grade. The only version you'll want to use medicinally is pharmaceutical-grade, which is 99%+ pure. Lower grades will contain varying levels of heavy metals and other contaminants.

Pharmaceutical grade will be marked USP, which stands for United States Pharmacopeia. Taking it with some ascorbic acid (vitamin C) facilitates absorption. To learn more, see "[The Surprising Health Benefits of Methylene Blue](#)," in which I interview Francisco Gonzalez-Lima, Ph.D., who has spent many years studying this drug.

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