

How to Measure and Optimize Your Mitochondrial Health

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

STORY AT-A-GLANCE

- › As you age, your mitochondrial function decreases, and this is a hallmark of both the aging process itself as well as most chronic disease. Bio-energy testing can quantitatively measure the function of your mitochondria
- › Even asymptomatic people in their 30s can have significantly decreased mitochondrial function. Early onset mitochondrial dysfunction is indicative of premature aging and future health problems
- › Two substances that significantly improve mitochondrial function are B vitamins and intravenous ozone
- › Certain lifestyle strategies will also improve mitochondrial function, the top two being interval exercise and an individualized diet. Lowering your stress and detoxing heavy metals are two others
- › Your thyroid may also need to be addressed if your mitochondrial function is impaired. The key here is using bioidentical hormones

Dr. Frank Shallenberger, author of “[Bursting With Energy: The Breakthrough Method to Renew Youthful Energy and Restore Health](#),” has been a natural medicine physician for nearly five decades.

He’s a true pioneer in the field and, as most good natural medicine physicians, a perpetual student. He was actually the first to innovate the use of nebulized hydrogen

peroxide, which has become my favorite intervention for upper respiratory infections, including SARS-CoV-2. Sadly, it's been widely disparaged, but those that have used it are typically really impressed by the results.

In this interview, we'll review a number of strategies you can use to optimize your mitochondrial health and function. After graduating from medical school, Shallenberger first went into trauma medicine. After about seven years, he transitioned into being a general practitioner and internist. Within months, however, he realized that nobody was getting well. In fact, many were getting sicker from the drugs he prescribed.

As it happened, Linus Pauling had a once-a-month study group in the area, which Shallenberger was able to join. He quickly realized there are far better ways to treat disease.

The Importance of Mitochondrial Optimization

One of the things Shallenberger has pioneered is bio energy testing that measures mitochondrial function. As you age, your mitochondrial function typically decreases, and this is a hallmark of both the aging process itself as well as most chronic disease.

He decided he wanted a way to test mitochondrial status, and by 2004 he had developed a system that evaluates how much oxygen you consume and, in real time, how much carbon dioxide (CO₂) you produce. This can give you a quantitative measure of how well your mitochondria are working.

“ My goal for all my patients is that no matter how old they are, they have youthful mitochondrial function. A lot of the stuff I've learned over the years is how to maximize that. ~ Dr. Frank Shallenberger ”

What he found was that even asymptomatic people in their 30s were having significantly decreased mitochondrial function. He calls this “early onset mitochondrial dysfunction,”

and it's indicative of future health problems, even if everything seems good and well right now.

“The conventional thinking has always been that our mitochondria lose their efficiency as a result of the aging process. But I started questioning that, and wondered if our mitochondria in fact lose their efficiency even before any signs of aging. And, the amazing thing I discovered was that mitochondrial efficiency can decrease significantly even in our 30s and 40s, long before any of the effects of aging.

I believe that this early decline is the primary factor that accelerates the aging process and makes us more vulnerable to the diseases of aging. And this is exactly what I have observed over the years. People with optimal mitochondrial function, no matter how old they are, rarely develop any of the diseases associated with aging, and routinely maintain full function even into their 90s.”

B Vitamins Needed for Optimal Mitochondrial Function

So, what are some of the most effective interventions Shallenberger has found for optimizing mitochondrial function? After a lot of testing and experimenting, the only two substances found to really move the needle were B vitamins and ozone treatment. He explains:

“B vitamins are absolutely critical for mitochondrial function – especially niacin, riboflavin and folate. Orally speaking, with niacin, I typically start them at 100 to 200 milligrams a day [but] you can go up to 2,000 mg easy on some patients. I use a B complex because I like to balance it out, but I'm focusing primarily on niacin, folate and riboflavin.”

Typically, when a deficiency of B vitamins is the cause of decreased mitochondrial function, I will see improved readings within two to three weeks, although the level of improvement can vary tremendously from one person to the next. An important caveat

here is that mitochondria are vulnerable to any number of assaults, including emotional stress.

"I have literally seen patients have great mitochondrial function, be under stress for two months, and have their mitochondria wiped out just from emotional stress," he says. "I haven't done the studies, but I'm pretty sure that if you get under a lot of emotional stress, I bet your mitochondria suffer a measurable hit within 48 hours."

Ozone Therapy

The other intervention Shallenberger found for mitochondria optimization is ozone therapy. He explains:

"First of all, people should understand what ozone is. When we talk about ozone and medicine, we're not talking about ozone in the atmosphere. We're talking about a very pure molecule, it's pure oxygen, period. There's nothing else in there. Regular oxygen that we breathe is what we call O₂, that's two oxygen atoms combined together.

Ozone is basically three oxygen atoms combined together. What makes that molecule so unique is that it is very electron deficient. It needs electrons big time. So as soon as you put that into the human body, or into any tissue, it's going to start grabbing electrons. And as it grabs the electrons, it's going to form molecules called peroxides [a reactive oxygen species, ROS].

So, after ozone treatment, you're loaded with peroxides, and these peroxides can stay in the body for a good seven, maybe as much as 14 days. These peroxides are what mediate the various physiological and biochemical effects of ozone. They're also, by the way, molecules that are electron deficient ...

Ozone is a hormetic molecule, it has a hormetic clinical effect. This means that at low doses, it does one thing, and as you increase the dose high enough, it

starts doing the exact opposite. So, deciding on the dose for ozone is pretty critical.

To stimulate mitochondrial function, I use relatively small doses, in the order of 10, maybe 12 mg ... I get ozone treatments myself every week, just because I can. And it would be super good if everybody could do that."

It is important that the ozone used intravenously be free of contaminants, so you need to use a machine that converts pure medical grade oxygen to generate pure ozone.

Ozone generators that convert air from an oxygen concentrator are only good for certain topical applications, not for intravenous injection. Also, while the peroxides are ROS, in this case, that's what you want. You do not want to try to counteract the oxidative stress with antioxidants before the treatment, and here's why:

"The reason is because I want these peroxides. When the ozone goes into the tissue, I want it to be interacting with lipids and maybe amino acids. I don't want it to interact with ascorbate, because then I'll get dehydroascorbate. That's not what I'm looking for. I'm looking for peroxides.

The basic thinking with ozone therapy is, you really never want to give any kind of substance that's going to donate electrons, like vitamin C or glutathione prior to the treatment, if you want to maximize peroxide production. Now, after the treatment, yeah. You want to do it after, but you got to have that sequence correct."

Lifestyle Strategies to Improve Mitochondrial Function

Certain lifestyle strategies will also improve mitochondrial function, the top two being interval exercise and a ketogenic diet (high in healthy fats and low in refined carbs, provided that's optimal for you. For additional details, see section below). Lowering your stress and detoxing heavy metals are two others. With regard to exercise, Shallenberger says:

“Resistance training is really important, especially for the over 60 crowd. For lean body mass-types of reasons, for resting metabolic reasons, it's very important. But it doesn't do what classic aerobic interval training does ...

For normal people, not athletes, to maintain good mitochondrial function, what you need is two 30-second intervals [where you go all-out, max exertion], followed by about four or five minutes of rest between the two, done three times a week. That's hardly anything ... [but] it's every bit as good as any of the harder exercise routines.”

The Case for Bioidentical Hormones

Your thyroid may also need to be addressed if your mitochondrial function is impaired. The key here is using bioidentical hormones, which unfortunately is getting more difficult to get a hold of. Bioidentical thyroid hormones are basically made from desiccated animal thyroid and therefore contain all four of the natural thyroid hormones: T1, T2, T3 and T4.

Conventional doctors typically use Synthroid or Levo-Thyroid, which only contains synthetic T4. Ideally, you want all four of them, but at bare minimum, you want T3 and T4.

“Thyroid is critical for a number of reasons,” Shallenberger says. “First of all, probably 80% of people over the age of 50 have suboptimal thyroid function. It's such a common problem ... When I first got my equipment, I started measuring resting metabolic rates. Resting metabolic rate is how much energy your cells are producing when you're actually not doing anything.

You're sitting very quietly in a chair. In other words, no exertion. How much energy do you need for no exertion? It turns out the resting metabolic rate is almost entirely determined by thyroid hormone. Thyroid hormone also activates something called uncoupling protein 3 (UCP3), which is an uncoupling receptor on the mitochondria, which stop mitochondria from self destructing.

The thyroid prevents self-destruction of mitochondria. Thyroid also stimulates mitochondrial biogenesis, and stimulates mitochondrial division, so that when the cells divide, you get representative DARs cells with the same number of mitochondria. Also, through UCP3, that's where a lot of fatty acids come in. Thyroid is very important for fatty acid metabolism of mitochondria.

So, [thyroid] hits mitochondria in about four or five different ways. It's absolutely critical for mitochondrial function. A lot of the times that's the big problem. Somebody comes in, their resting metabolic rate's low, the mitochondrial function's low. I give them enough thyroid to bring the resting metabolic rate up to what would be considered close to optimal, and bang, the mitochondrial function goes right up with it."

Thyroid Tests Are Unreliable for Diagnosis

Unfortunately, many of the thyroid blood tests aren't particularly good. TSH is particularly useless, according to Shallenberger. He's convinced that measuring resting metabolic rate and increasing the dose of bioidentical thyroid hormone until you're at an optimal or near-optimal metabolic resting rate is a far better way to gauge how much thyroid medication you need. For general reference, the most commonly used dose is between 1 grain (60 mg) and 1.5 grains (90 mg).

"I had lots of these cases. They'll tell me, 'I feel really good. Everything's wonderful. Thank you so much.' Then they come back maybe a year later and they say, 'I'm miserable ... I saw my doctor, he did the thyroid test and said 'Oh, you're being way overdosed.' So, he reduced the dose and the test is looking good now, but I feel like crap again.'

The doctor says, that's OK, 'because your tests are looking good.' So, that's how good these tests are. They're totally useless. The patient comes back to me, I put them back on the thyroid and that's the end of that story. I'll use T4 and T3 to monitor what I'm doing. But the TSH is absolutely useless. And they're all useless for diagnostic purposes."

The Importance of Being Metabolically Flexible

About 90% of the population are metabolically inflexible, and that will have a tremendous impact on their mitochondrial function. Most eat far too many refined carbs and have an impaired ability to use fat as their primary fuel. To address that, you typically need to significantly reduce your carb intake and increase healthy fats.

This is not a 100% absolute certainty, however. The mitochondrial machinery in some people is preferentially adapted to carbs and they won't do well on a high-fat, low-carb diet. The good news is you can actually measure how well your mitochondria are working on a specific diet, using Shallenberger's test. This way, you can really get a clear idea of what your personalized ideal diet is. Shallenberger explains:

"Mitochondria have the ability to generate energy by either burning glucose or fatty acids. If they're purely burning glucose, they produce twice as much CO₂ than if they're purely burning fat.

If I look at the ratio between oxygen consumed and carbon dioxide produced, since it's a linear equation, I can tell them exactly how much energy they're generating from glucose and how much energy they're generating from fatty acids. We have that capability, just from looking at these numbers, to determine that ...

Now, carbohydrates in certain people suppress fatty acid metabolism. There's a subset of the population that, when they eat carbs, it's mitochondrial suppressive. The rationale is that since we're all different, there are going to be a subset of people whose mitochondria prefer to get their protons from glucose.

There's going to be another subset of people whose mitochondria prefer to get their protons from fatty acid. They're just more efficient that way. So, you have these two extremes. The rest of us fit on some continuum between those two extremes."

Nebulized Hydrogen Peroxide

As mentioned, Shallenberger was way ahead of everyone else with the use of nebulized hydrogen peroxide. Anytime you inhale something, it enters your bloodstream.

Shallenberger had been using intravenous hydrogen peroxide for about 20 years when he suddenly had the idea to inhale it.

Respiratory viruses, of course, tend to hang out in the sinuses, respiratory tract and lungs. Hydrogen peroxide, meanwhile is known to kill most known viruses on contact.

“It's pretty simple, but it's unbelievably effective,” he says. All you need is:

- A plug-in jet nebulizer
- 3% food grade hydrogen peroxide (food grade does not contain chemical stabilizers)
- Saline
- Optional: 1 to 2 drops Lugol's iodine

Simply dilute the peroxide by mixing 7 teaspoons saline with one-fourth teaspoon of peroxide. This gives you a 0.1% solution, which is perfectly safe to inhale. If you like, you can add one drop of Lugol's iodine into the cup along with the solution.

Heavy Metal Detox

Heavy metal toxicity is another problem that can take a toll on your mitochondria. To address heavy metals, Shallenberger typically uses a combination of colonics, saunas and chelation therapy. Like me, he's a big fan of saunas. While most use far-infrared saunas, I prefer near-infrared saunas, for several reasons.

For starters, near-infrared penetrates much deeper into your tissues, releasing toxins. Importantly, 95% of melatonin is also produced in your mitochondria in response to near-infrared light. Melatonin is a very powerful antioxidant that helps mop up ROS in the mitochondria. Melatonin also helps increase glutathione, which is a major

detoxification agent. For tips on how to create an EMF-free sauna, listen to our interview, as we go into more details than what I've summarized here.

TH1 Versus TH2 Immunity

In closing, we touch on immune function. Your immune system is divided into two "arms" or branches, the innate immune system (TH1) and the humoral immune system (TH2). If your innate immune system is not working well, you're more prone to infection and illness. Unfortunately, vaccines of all kinds suppress TH1, pushing you toward a TH2 dominance.

"In 1994, there was a study published, looking at homosexual men. It had to do with AIDS and all these men were HIV positive, but only a portion of them had AIDS. They found that of the ones who had AIDS, 100% of them were all in TH2 dominance. Of the ones that didn't have AIDS, only 30% were in TH2 dominance.

They were in TH1 dominance ... I looked at that study and I thought, 'Wow, you're telling me that 30% of men in the control group were already in TH2 dominance? That's pretty pathetic. This basically means their innate immune system is more or less shut down, and they're in a TH2 humoral system imbalance.

I thought, they've ruined the TH1, because what happens is that the TH2 system produces cytokines that suppress TH1. TH1 produces cytokines that suppress TH2. So, it's sort of like one aspect of the immune system is saying, 'I got this, we don't need you anymore.'

So, we've got a number of our population of so-called healthy people that are in a TH2 dominance. In the '80s, it was a big thing to test for antibodies. Everybody was testing for antibodies. The conclusion we came to is that if you have a lot of antibodies, that means you're super-duper infected versus somebody who doesn't have a lot of these antibodies.

Turns out that's just not the case ... The problem is not that these antibodies are being caused by super infection-type situations. The problem is they're in TH2 dominance and that's what they do. They live off antibodies.

Maybe as much as one-third of the population is already in TH2 dominance. Why is that? ... What are we doing that's making all these antibodies? Hello, vaccines. But what's the definition of a good vaccine? It's one that makes an antibody. Every time you get a vaccine, you're automatically suppressing your innate immunity.

Statistical data came out a couple years ago, comparing the death rate from COVID in countries where the population was highly vaccinated for the flu in 2019 as opposed to countries with a low flu vaccine rate. And the death rate was something like 400% greater in the countries where most of the people had the 2019 influenza vaccines.

That stands to reason, because they suppressed their innate immunity. That was one thing that got to me. You know, vaccines aren't really helping this game here. The other thing that got to me is that we know ozone stimulates gamma interferon and IL2, which are TH1 stimulants that act to suppress TH2.

So, my conclusion, finally, was that when you add it all up, why does ozone work for every viral infection you can get? ... It has to do with the fact that I'm taking them out of a TH2 dominance putting them in a TH1 dominance."

More Information

To learn more, you can pick up a copy of "[Bursting With Energy: The Breakthrough Method to Renew Youthful Energy and Restore Health](#)," which is loaded with good advice.

If you're interested in getting bio energy testing to measure your mitochondrial function, check out Shallenberger's website, www.antiagingmedicine.com. Aside from

Shallenberger's clinic in Nevada, there are also [testing centers](#)¹ in a dozen other states, and several other countries.

Sources and References

- ¹ [Bio-Energy Testing Centers](#)