



MITOQ<sup>®</sup>

# Neurological health and mitochondria

edition ii

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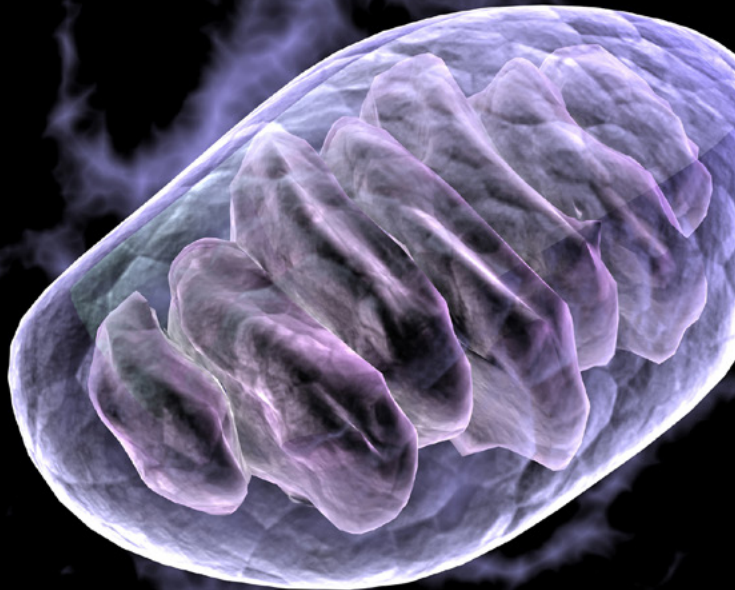
## What are Mitochondria?

Mitochondria are tiny organelles found in almost all of our cells, and they're responsible for generating the energy our cells need to function.

Mitochondria are like tiny power plants that combine the food we eat with the air we breathe to make the energy our cells need to operate. Mitochondria are also crucial to proper cell growth and play many other important roles within the cell.

It turns out that having lots of energy available to our cells is incredibly important to our health. If our cells don't get the energy they need, then they simply can't do all the jobs they are tasked with.

Over the last decade, scientists have begun to recognize the link between mitochondrial function (or decline of function) and our health and certain diseases. It is becoming increasingly apparent that our overall health, and even how fast we age, is closely related to how well our mitochondria are functioning.



# Neurons and the nervous system

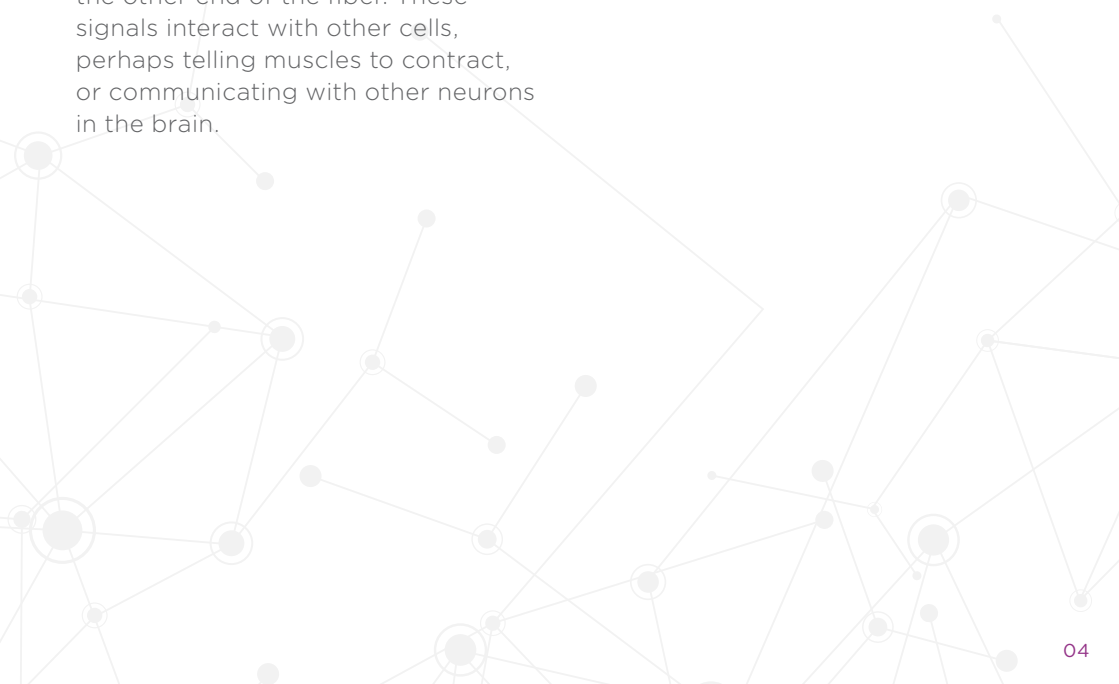
## - How do they work?

Neurons are the primary cells that make up our nervous system, our body's control network. Together they control our muscles, store our thoughts and memories and regulate all of our organs and bodily functions.

Neurons are made up of a cell body and a nerve fiber through which electrical pulses are sent. Healthy nerve fibers are similar to electrical cables, and have an insulating layer around them called myelin.

When a neuron sends a pulse down its fiber, chemical signals called neurotransmitters are released from the other end of the fiber. These signals interact with other cells, perhaps telling muscles to contract, or communicating with other neurons in the brain.

Generating these electrical pulses, releasing neurotransmitters and general cell house keeping requires a lot of energy. Although our brains only make up about 2% of our body weight, they use up to 20% of our body's total energy expenditure. This means that neurons are highly dependent on our mitochondria being as healthy as possible.



## What happens when things go wrong?

Our nervous system can be thought of like an electrical network, with our brains as a computer and our nerve fibers like signal wires. If the computer doesn't have enough power, or the wires get damaged, the signals don't get through and the whole system stops working properly.

There are a wide range of conditions that can affect our nervous system. Known as neurological disorders, they can result in the gradual loss of control of our muscles, organs or our cognitive ability.

Neurological conditions affect as many as one billion people worldwide, and can be a huge burden on patients, their caregivers and on society as a whole.

We don't know what causes many of these disorders but they can be triggered by faulty genes, other diseases like autoimmune conditions and infections, or by injuries and toxins.

Some of these conditions occur because our nerve cells start to degrade or die. Others can be a result of the insulating myelin layer being damaged so that our nerve cells can't communicate properly anymore.

As with many other conditions however, we are realizing more and more that there is a very strong link between conditions of the nervous system and the health of our mitochondria.

## What happens to mitochondria in neurological conditions?

When we are young and healthy the mitochondria in our neurons are working at 100%, delivering all the energy needed. We are strong, full of energy, we have sharp memories and we sleep well, and — for the most part — we are free from serious disease.

As we get older our mitochondria naturally start to decline in function. They are thought to decline at around 10% per decade from our thirties.

We don't notice it immediately but we start to have less energy, we don't recover from illness or injury as quickly, and we may start to notice small things like tiredness, memory-loss and muscle weakness.

You've probably heard of free radicals and the damage they can do to our bodies. When mitochondria produce all that energy our neurons need, they also produce lots of free radicals. It's a lot like the exhaust produced by an engine. While free radicals do have some uses in our bodies, they can also be very damaging if not kept in check. Healthy mitochondria are very good at keeping this balance, but as they decline they aren't able to maintain their arsenal of antioxidants and the damage begins to pile up.



An excess of free radicals can attack the mitochondria and damage the delicate mitochondrial membranes. When this happens the free radicals can also leak out into the rest of the cell. This can cause damage to many components of our neurons, even their DNA.

We get by because our neurons are incredibly clever at re-organizing their activity so that their main jobs get done. But their lack of energy means some other important but non-urgent jobs don't get done — like processing and removing waste, or repairing cellular components.

Over time we experience a slow breakdown of our cellular machinery. This starts to impact on how well our neurons function and affects our strength, our cognitive function and our control over our bodies. The ongoing cycle of more and more damage can eventually develop into various neurological conditions, and our neurons might stop working properly or even start to die.

What we are experiencing is known as neurodegeneration.

## A word on free radicals

For a long time, it was thought that free radicals were the enemy and it was recommended we take antioxidant supplements to counter them.

We now know that free radicals are not all bad. In fact, a certain level of free radicals is good for us. We use them to send important messages within our cells and to neighboring cells. Our immune cells also use free radicals as part of their defense mechanism against infection.

Free radicals become a problem when they get out of balance and we shift into a state called "Oxidative Stress". Too much oxidative stress at the cellular level can damage cells and lead to disease. Neurons are particularly vulnerable to oxidative stress and it has been implicated as a major culprit in the development of many neurological disorders.

## Improving mitochondrial function to improve neurological health

If you can improve your mitochondrial function, then you may be able to reduce or reverse some symptoms of neurodegeneration by improving the energy available to your neurons. This allows your neurons to perform their functions properly, slows free radical leakage into your cells, and reduces the daily wear and tear that is damaging your cell contents and DNA.

When your mitochondria are functioning optimally, your cells get enough energy and will start to act young again, and in many cases — because cells are self-repairing — you will see a reversal in the effects of damage on the cell.

You will notice an improvement in overall energy and a sharper mental focus as your whole body starts to feel and react to the increase in available energy.

Improving mitochondrial function is something that anyone can do at any time of their life with a few simple steps.





## How can we support our mitochondria?

All the things that you associate with being good for your health — a good diet, exercise and having a healthy environment — are very important for your mitochondria as well.

When your diet is high in calories or unbalanced by too much sugar and refined carbohydrates, it overloads your mitochondria and puts them under stress.

When you exercise, your mitochondria thrive. When you are inactive, they decrease in number and don't function optimally.

Your environment and lifestyle also impact negatively on mitochondria — be it through exposure to pollutants or over-consumption of things like alcohol or tobacco.

But it's important to note that even if you look after your mitochondria through a healthy diet and exercise, they do still decline naturally. This is why taking a supplement that actively supports mitochondrial function is a very good strategy to help you stay younger and feel healthier for longer.

Taking a supplement that supports mitochondrial function, in combination with a good diet and exercise regime, will put you in the very best position for optimal health, and can improve the risk and symptoms of many neurological conditions.

### A word on antioxidants

Because some free radicals are important for cell messaging and the immune system (amongst other things), you don't want to be taking mega-doses of broad spectrum antioxidants that may interfere with these natural processes.

For this reason, it's best to carefully choose which antioxidant to take and to not take too many.

Some of the best antioxidants are ones that stimulate our natural antioxidant protection systems, because these systems have evolved to ignore the good free radicals and target the bad ones.

Newly discovered mitochondria-targeted antioxidants that ignore good free radicals whilst fighting the bad ones that are causing oxidative stress, are an important and significant advance.

## Mitochondria - targeted antioxidants

Mitochondria-targeted antioxidants are a new type of antioxidant, able to deliver a payload of free radical defense directly into the mitochondria. Discovered and developed at Otago University (Dunedin, New Zealand), they are considered to be a significant advance in antioxidant technology.

Until this discovery, no one had been able to restore the mitochondrial antioxidant defense system in a meaningful way. This is because the mitochondrial membrane is particularly impermeable to most substances. Many antioxidant supplements are simply not able to get to where they need to be—inside the mitochondria in your cells.

By restoring the mitochondrial free radical defense system, we achieve the double benefit of both restoring mitochondrial function and reducing free radical leakage into the cell. This supports optimal mitochondrial health and function and results in improved energy production for the cell. Our neurons get an energy boost, and that helps them operate like they did when they were younger and healthier.

## Introducing MitoQ

When the researchers at Otago University identified a way to target mitochondria with antioxidants, they looked carefully to identify the most important antioxidant within mitochondria. That antioxidant was CoQ10. MitoQ is a mitochondria-targeted form of this very popular supplement.

MitoQ accumulates inside the mitochondria 847 times more effectively than all other forms of CoQ10 supplements. And when you increase levels of CoQ10 in the mitochondria it is like 'tuning up' your cellular engine, making more energy available to your cells and reducing oxidative stress from free radical damage.

Over the last decade, MitoQ has been studied by researchers all around the world as they look to understand what happens when you improve mitochondrial function and reduce oxidative stress in various models of human disease and aging, including many common neurological disorders.

Recently, MitoQ was selected for a world-leading independent research program in the USA to evaluate its effect on slowing and potentially reversing the cellular aging process.

To date, more than \$50 million of research has been conducted, and over 200 scientific papers have been published, investigating MitoQ's effect.

MitoQ has helped thousands of people with neurological conditions to live happier and more active lives.

To learn more about MitoQ please visit [mitoq.com](http://mitoq.com)

Along with a balanced diet and exercise, MitoQ sets your mitochondria up with optimal energy for cell function. When your cells have all the energy and defenses they need, they stay younger for longer, you slow the aging process, and your neurons have the resources to support your body for an optimal healthy lifespan.





Always read the label and use as directed.  
If symptoms persist see your healthcare professional.  
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