



## Mitochondrial dysfunction

Mitochondria are an integral part of our make-up and we would not survive without them. Unfortunately, these delicate organelles are easily damaged by exposure to environmental toxins and excessive free radical production. In addition, dietary deficiencies or genetic mutations can also disrupt their functioning. Because they selfreplicate, defective mitochondria end up making more defective mitochondria and widespread mitochondrial dysfunction is associated with numerous degenerative disorders and other diseases of modern life. MitoQ is able to penetrate mitochondria and accumulates inside at concentrations several hundred-fold higher than in the blood. MitoQ helps protect your body against oxidative stress and supports the body's defences against disease when taken in conjunction with a healthy diet and exercise.

Mitochondria are free-floating, bean-shaped organelles that live in almost every cell of our body. They generate more than 90% of the energy needed by our bodies to sustain life and promote growth. Cells that require the most energy - such as the brain, heart, skeletal muscles, and the eye - contain the most mitochondria.

Besides converting the food we eat into fuel in the form of adenosine triphosphate (ATP), mitochondria are also involved in the manufacture of DNA, haemoglobin, oestrogen and testosterone.

They help metabolise cholesterol and produce antioxidants such as coenzyme Q10 which neutralise free radicals and decrease oxidative stress. They are the only separate structure in the cell to have their own DNA which gives them the ability to self-replicate and increase their numbers if the cell requires more energy, such as during growth or intense exercise. Mitochondria also help the cell perform specialised functions, for example, mitochondria in liver cells allow the cell to breakdown toxic ammonia into harmless urea which is then excreted. Amazingly, mitochondrial duties change as we develop from embryo to adult, and our tissues grow, mature, and adapt to the postnatal environment.

Mitochondria are such an integral part of our make-up that we wouldn't survive without them. The Mitochondrial Free Radical Theory of Ageing (MFRTA) suggests that longevity comes down to well-performing mitochondria and well- controlled rates of free radical production. Support for this theory is found in

studies on long-lived animals which show low rates of free radical production and mitochondrial and cellular membranes relatively resistant to free radical attack. The MFRTA offers an explanation for longevity variation among different animal species that is not related to size, shape, or cognitive ability.

Research has also established a link between mitochondrial dysfunction and numerous degenerative disorders. Most autoimmune disorders also appear to have a mitochondrial basis to them. In addition, experts have suggested any illness that has symptoms of fatigue or a reduced energy component to it could be related to mitochondria.

But how easy is it for mitochondria to malfunction? Unfortunately... relatively easy. Environmental toxins such as pollution, industrial chemicals, cigarette smoke, and UV radiation also damage delicate mitochondria. Diets deficient in certain vitamins or minerals or high in trans fats, sugar, burnt or processed meats increase free radical production and exhaust our natural antioxidant supply. Free radicals left to roam freely steal electrons off the next closest stable molecule in their vicinity, damaging its molecular structure. This may be a fat molecule making up double membrane of the mitochondria or part of the mitochondrial DNA. Initially, damage may be minimal but because mitochondria can self-replicate, defective mitochondria end up making even more defective mitochondria. Symptoms start to become more apparent, with the first usually being a loss of energy as ATP production compromised. Hundreds of other vital cellular processes are also disrupted and cells die. Our bodies enter a state of oxidative stress and symptoms become more widespread, as the disruption starts to impact on the functioning of our brain, liver, heart, kidney, and several other organs. Whole body systems, such as our immune system, are also affected.

Which is why scientists are now targeting mitochondria as a promising new avenue for the support of a whole raft of conditions believed to be due to mitochondrial dysfunction. MitoQ is a revolutionary mitochondrial-targeted supplement that contains coenzyme Q, a potent antioxidant that is naturally produced within our bodies. MitoQ has been formulated to penetrate mitochondria, and accumulate at one of the most prolific sites of free radical production. This puts MitoQ right where it is needed most at concentrations several hundred-fold higher than if it just stayed in the blood. MitoQ neutralises excessive free radicals and stabilises the mitochondrial membrane, protecting it

from subsequent free radical attack. When taken in conjunction with a healthy diet and exercise MitoQ helps protect your body against oxidative stress and supports the body's defences against degenerative diseases. So fulfil your goal to live a long and healthy life and take MitoQ today.

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

## **Bibliography**

Chinnery P. Mitochondrial Disorders Overview 2010 <http://www.ncbi.nlm.nih.gov/books/NBK1224/>

Frequently asked questions. United Mitochondrial Disease Foundation <http://www.umdf.org/site/pp.aspx?c=8qKOJ0MvF7LUG&b=7934639#m6>

Mitochondrial Diseases TSBVI. <http://www.tsbvi.edu/seehear/spring02/mitochondrial.htm>

Mitochondria Functions - More mitochondria mean more PBs, but what do you have to do to get them? Mitochondria functions and research. <http://www.pponline.co.uk/encyc/0129.htm>

Smith R, Hartley R, Cocheme H, Murphy M. Mitochondrial pharmacology. Trends in Pharmacological Sciences 2012;33(6):341-352

Smith R, Murphy M. Animal and human studies with the mitochondria-targeted antioxidant MitoQ. Annals of the New York Academy of Sciences 2010;1201:96-103

What is mitochondrial disease? United Mitochondrial Disease Foundation. <http://www.umdf.org/site/pp.aspx?c=8qKOJ0MvF7LUG&b=7934627>

Wilson L. Mitochondrial dysfunction and nutritional balancing <http://drlwilson.com/ARTICLES/MITOCHONDRIAL.htm>

