

THE BETTER HEALTH NEWS

MITOCHONDRIA

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The mitochondria are membrane-bound organelles found in most eukaryotic cells. They are sometimes described as "cellular power plants" because they generate most of the cell's supply of (ATP). In addition to supplying cellular energy, mitochondria are involved in other tasks such as signaling, cellular differentiation, cell death, as well as the control of the cell cycle and cell growth. Mitochondria have been implicated in several human diseases, including mitochondrial disorders and cardiac dysfunction, and may play a role in the aging process. More recent research indicates that inflammation, allergy, heart failure, autoimmune disease, autism, migraine headaches, neurodegenerative diseases, fibromyalgia, insulin insensitivity, and a variety of chronic disorders are correlated with mitochondrial defects.

Mitochondria contain two major membranes. The outer mitochondrial membrane fully surrounds the inner membrane, with a small intermembrane space in between. The outer membrane has many protein-based pores that are big enough to allow the passage of ions and molecules as large as a small protein. In contrast, the inner membrane has much more restricted permeability, much like the plasma membrane of a cell. The inner membrane is also loaded with proteins involved in

electron transport and ATP synthesis. This inner membrane surrounds the mitochondrial matrix, where the citric acid cycle transports the electrons that travel from one protein complex to the next in the inner membrane. At the end of this electron transport chain, the final electron acceptor is oxygen, which combines with hydrogen to form water. At the same time, the electron transport chain produces ATP. (This is why the process is called oxidative phosphorylation.)

During electron transport, the participating substrates push protons from the matrix out to the intermembrane space. This creates a concentration gradient of protons that another protein complex, called ATP synthase, uses to power synthesis of the energy carrier molecule ATP.

Mitochondria are unusual organelles in that they are surrounded by a double membrane and retain their own small genome. They also divide independently of the cell cycle by simple fission. Mitochondrial division is stimulated by energy demand, so cells with an increased need for energy contain greater numbers of these organelles, compared to cells with lower energy needs.

MITOCHONDRIA AND CHRONIC ILLNESS

An article appearing in *Alternative Therapies in Health and Medicine* (2014 Winter;20 Suppl 1:18-25) talks about how proper function of the mitochondria is important to maintain good health. Loss of mitochondrial function, according to the article by Garth Nicolson, can result in excess fatigue and other symptoms that are common complaints in almost every chronic disease. At the molecular level, a reduction in mitochondrial function occurs as a result of the following changes: (1) a loss of maintenance of the electrical and chemical transmembrane potential of the inner mitochondrial membrane, (2) alterations in the function of the electron transport chain, or (3) a reduction in the transport of critical metabolites into mitochondria. In turn, these changes result in a reduced efficiency of oxidative phosphorylation and a reduction in production of adenosine-5'-triphosphate (ATP). Several components of this system require routine replacement, and this need can be facilitated with natural supplements. Clinical trials have shown the utility of using oral replacement supplements, such as L-carnitine, alpha-lipoic acid (α -lipoic acid [1,2-dithiolane-3-pentanoic

acid]), coenzyme Q10 (CoQ10 [ubiquinone]), reduced nicotinamide adenine dinucleotide (NADH), membrane phospholipids, and other supplements. Combinations of these supplements can significantly reduce fatigue and other symptoms associated with chronic disease and can naturally restore mitochondrial function, even long-term in patients with intractable fatigue.

Another article, appearing in the *Journal of Cell Biochemistry* (2007 Apr 15;100(6):1352-69) links metabolic syndrome to damage to the mitochondria. Metabolic syndrome consists of a cluster of metabolic conditions, such as hypertriglyceridemia, hyper-low-density lipoproteins, hypo-high-density lipoproteins, insulin resistance, abnormal glucose tolerance and hypertension, that combined with genetic susceptibility and abdominal obesity, are risk factors for type 2 diabetes, vascular inflammation, atherosclerosis, and renal, liver and heart disease.

One of the defects in metabolic syndrome and its associated diseases is excess cellular oxidative stress (mediated by reactive oxygen and nitrogen species, ROS/RNS) and oxidative damage to mitochondrial components, resulting in reduced

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efficiency of the electron transport chain. Recent evidence indicates that reduced mitochondrial function caused by ROS/RNS membrane oxidation is related to fatigue, a common complaint of MS patients. Lipid replacement therapy (LRT) administered as a nutritional supplement with antioxidants can prevent excess oxidative membrane damage, restore mitochondrial and other cellular membrane functions and reduce fatigue. Recent clinical trials have shown the benefit of LRT plus antioxidants in restoring mitochondrial electron transport function and reducing moderate to severe chronic fatigue. Thus LRT plus antioxidant supplements should be considered for metabolic syndrome patients who suffer from various degrees of fatigue.

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RESTORE YOUR MITOCHONDRIA

So many of chronically ill patients have problems with their mitochondria. The mitochondria are susceptible to poor diet, dysbiosis/leaky gut, oxidative stress, nutritional deficiency and environmental stress. For treating mitochondrial issues,

Supplements that can be helpful include:

Coenzyme Q 10: This product supports the electron transport chain. Research has shown it to be beneficial to patients with migraine headaches, high blood pressure, CHF and heart disease.

NAC: Helps with detoxification by increasing glutathione levels (the most important water-soluble antioxidant in the body).

Acetyl-L-Carnitine: Decreases gluconeogenesis, reduces serum glucose, increases peripheral glucose uptake, improves insulin sensitivity, promotes triglyceride clearance, and protects for endothelial dysfunction and atherosclerosis. A large study has shown **Acetyl-L-Carnitine** to be beneficial to fibromyalgia patients (Clin Exp Rheumatol. 2007)

Multiple Vitamin: A high-potency multiple vitamin designed to address nutritional deficiency.

Essential fatty acids help anchor enzymes to the inner mitochondrial membrane. DHA is important for the structure of the mitochondria as well as the function of the electron transport chain.

D-Ribose: Research has shown it to be valuable for energy production in cells. In 1973 Heinz Gerd Zimmer conducted research at the University of Munich and found that D-Ribose helped energy-starved hearts recover from ischemia. Subsequent research went on to show that D-Ribose was the limiting element in energy recovery in ischemic tissue and that it was necessary for energy production in the cell.

Products that deal with dysbiosis can also be beneficial to the mitochondria. Herbal products that kill yeast, like oregano oil or garlic are useful. Probiotics may also be of benefit. Products that aid in detoxification can also be beneficial to the mitochondria.

Antioxidants, like vitamins A, C and E, as well as bioflavonoids can be taken to protect from oxidative stress. Oxidative stress can cause mitochondrial dysfunction and mitochondrial dysfunction can cause oxidative stress (it is a vicious cycle).

To keep the
body in good
health is a
duty...
otherwise we
shall not be
able to keep
our mind strong
and clear.

Buddha

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GMOS AND ROUNDUP

An article appearing in *Food and Chemical Toxicology* (2012 Nov;50(11):4221-31. doi: 10.1016/j.fct.2012.08.005. Epub 2012 Sep 19), looked at the link to GMOs, Roundup hebicide, and disease. The health effects of a Roundup-tolerant genetically modified maize (from 11% in the diet), cultivated with or without Roundup, and Roundup alone (from 0.1 ppb in water), were studied 2 years in rats. In females, all treated groups had a 2-3 fold increase in death rate as compared to controls, and more rapidly. This difference was also visible in 3 male groups fed GMOs. All results were hormone and sex dependent, and the pathological profiles were comparable. Females developed large mammary tumors almost always more often than and before controls, the pituitary was the second most disabled organ; the sex hormonal balance was modified by GMO and Roundup treatments. In treated males, liver congestions and necrosis were 2.5-5.5 times higher. This pathology was confirmed by optic and transmission electron microscopy. Marked and severe kidney nephropathies were also generally 1.3-2.3 more

frequent. Males presented 4 times more large palpable tumors than controls which occurred up to 600 days earlier. Biochemistry data confirmed very significant chronic kidney deficiencies; for all treatments and both sexes. Seventy-six percent of the altered parameters were kidney related. These results can be explained not only by the non linear endocrine-disrupting effects of Roundup, but also by the overexpression of the transgene in the GMO and its metabolic consequences.

The average American consumes 193 pounds of GMO food each year. According to research in the *Journal of Environmental and Analytical Toxicology*, "Exposure of mammals to glyphosate may cause loss of mitochondrial transmembrane potential and result in oxidative stress to liver and brain. Both apoptosis and autophagy are involved in glyphosate toxicity mechanisms. Case reports indicated that exposure to glyphosate was related to Parkinsonism." Researchers have found higher glyphosate levels in chronically ill people than in healthy subjects.