

Mitochondria

Supporting Your Body's Cellular Energy Generators to Help Prevent and Overcome Chronic Disease



Inside of the cells of every plant, animal and human being you will find small structures called mitochondria. These rod-shaped organelles (cellular organs) are the power plants for cells. Their job is to convert the calories from carbohydrates, fats and proteins into energy the cells can use. They provide every cellular process with the energy it needs to function using a cyclic process known as the Krebs cycle.

Researchers are now discovering that mitochondria do more than produce energy. They also play a role in the synthesis of fatty acids, the regulation of cellular levels of amino acids and enzyme cofactors, balancing levels of heme (the iron compound that forms the basis of hemoglobin), calcium balance, neurotransmitter synthesis and insulin secretion.

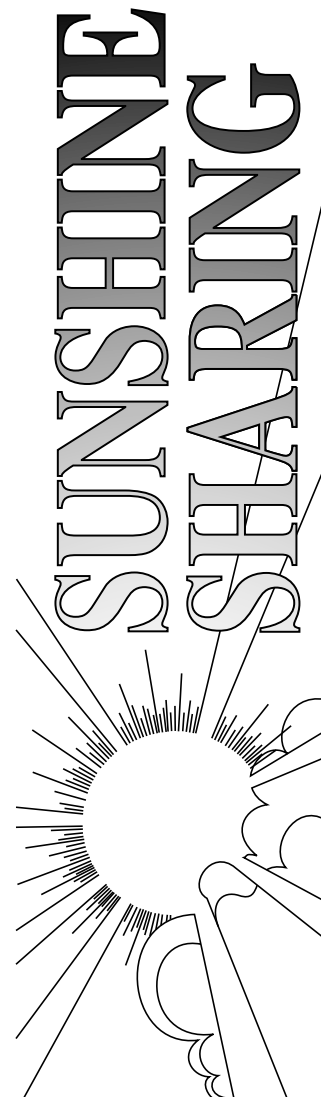
Mitochondria also produce reactive oxygen species (free radicals) that can damage their own structures as well as other structures in the cell if there aren't enough antioxidants present to regulate them. They also play a role in apoptosis, which is the mechanism that triggers cells to die. Apoptosis is the process by which the body gets rid of virally infected cells and cancer cells. Without apoptosis multicellular organisms can't protect themselves from cells that have started to malfunction.

Mitochondrial Dysfunction as a Root Cause of Disease

As all this research is coming forth, science is discovering that mitochondrial dysfunction is involved in numerous degenerative diseases. First, since mitochondria produce energy, anyone who has serious, long lasting fatigue probably has mitochondrial dysfunction. Mitochondrial problems are also involved in diabetes, deafness and neuropathy. It's also being proposed that health conditions such as cancer, diabetes, fibromyalgia and serious mental illnesses (such as schizophrenia and bipolar disease) may result from mitochondrial dysfunction, although the research on the role mitochondria play in all these diseases isn't clear yet.

An article in *Integrative Medicine* in August of 2014 suggested that mitochondrial dysfunction may be occurring in "... neurodegenerative diseases, such as Alzheimer's disease, Parkinson's disease, Huntington's disease, amyotrophic lateral sclerosis, and Friedreich's ataxia; cardiovascular diseases, such as atherosclerosis and other heart and vascular conditions; diabetes and metabolic syndrome; autoimmune diseases, such as multiple sclerosis, systemic lupus erythematosus, and type 1 diabetes; neurobehavioral and psychiatric diseases, such as autism spectrum disorders, schizophrenia, and bipolar and mood disorders; gastrointestinal disorders; fatiguing illnesses, such as chronic fatigue syndrome and Gulf War illnesses; musculoskeletal diseases, such as fibromyalgia and skeletal muscle hypertrophy/atrophy; cancer; and chronic infections." [<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4566449>]

That's quite an impressive list, which is why we're going to focus on mitochondrial health in this issue of *Sunshine Sharing*. We'll provide you with some interesting facts about mitochondria, discuss briefly how mitochondria create the energy and factors that contribute to mitochondrial dysfunction. We'll also talk about ketogenic diets as well as supplements that may help improve mitochondrial function.



Your guide to better health the natural way.

Vol. 28 No. 8

Important Notice

The information in *Sunshine Sharing* is for educational purposes only and should not be used to diagnose and treat diseases. If you have a health problem, we recommend you consult a competent health practitioner before embarking on any course of treatment.

Sunshine Sharing is an independent educational publication and receives no financial support from any herb or health product manufacturer. Your comments, questions and personal experiences are welcome. Send them to *Sunshine Sharing*, P.O. Box 911239, St. George, UT 84791-1239 or comments@treelite.com.

Copyright © 2017 by Tree of Light (a division of Kether-One, Inc.). Photocopying this publication for distribution is strictly forbidden. If you receive a photocopy of this publication, the distributor of said photocopies is in violation of copyright law.

Managing Editor/Writer: Steven Horne
Editor: David Horne
Associate Editors: Carolyn Hughes,
Leslie Lechner



Caring for Your Mitochondrial Power Plants

Life, and health, are largely dependent on energy. Cells move around, change shape, pump substances in and out of their membranes, manufacture things and reproduce. Every one of these activities requires energy.

In a car, the carburetor mixes the fuel (gasoline) with oxygen which the spark plugs ignite. This releases the energy stored in the fuel so the engine can run. In cells, mitochondria perform this role. They combine fuel derived from food with oxygen through the Krebs cycle, converting calories into usable energy in the form of a molecule called adenosine triphosphate (ATP).

Released into the cell, ATP can remain in the cell for hours until it is ready to be used for energy. When cellular processes need this energy, ATP is broken down into adenosine diphosphate (ADP), releasing a molecule of phosphorus and the stored energy. ADP can then be recharged in the mitochondria and turned back into ATP.

Mitochondria Need Nutrients

This entire process requires enzymes which depend on nutrients to function. Vitamins like C, D, E, thiamine and riboflavin and minerals like magnesium, manganese, calcium and phosphorus are needed to sustain both the Krebs cycle and the processes that feed fuel into the mitochondria.

Being stripped of these nutrients, refined carbohydrates cannot be efficiently turned into energy. It's like putting contaminated gasoline into a car. Instead of running cleanly and efficiently, the carburetor and engine will be gummed up with carbon deposits, reducing power output and wearing the engine out faster.

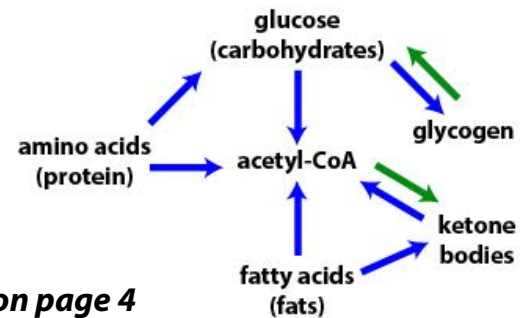
Put simply, refined carbohydrates are dirty fuel for mitochondria. They simply were not designed to handle massive amounts of sugar without the accompanying nutrients found in the whole foods those sugars came from. So, although there are many things that can cause mitochondria to malfunction (such as genetics), the primary cause of mitochondrial dysfunction in most people is a diet loaded with refined carbohydrates.

Ketogenic Diets

One way to help revitalize your mitochondrial power plants is to go on a ketogenic diet. This is believed to help to clear the carbohydrate metabolic pathways in the mitochondria and rebalance mitochondrial function. The result is more efficient energy production and less free radical damage.

It is important to understand that the mitochondria don't directly utilize carbohydrates, fats or proteins. All of these potential fuel sources must be converted into a compound called acetyl-coA, as shown in the diagram below. It is acetyl-coA that is drawn into the mitochondria and converted to energy.

The cells of the brain and nervous system rely primarily on glucose to produce acetyl-coA. Thus, the brain requires a



Continued on page 4

Mitochondrial Mysteries

Cells are the most basic component of living things, but they are extremely complex in both their structure and function. Science is still unraveling the mysteries of the cell and there are still many things we don't know about cellular functions.

Like the body as a whole, cells have systems and structures. Cell structures are called organelles (in essence, tiny organs). One very critical organelle in the cells of all multicellular organisms is the mitochondrion (plural, mitochondria).

Mitochondria are part of all multi-cellular plants and animals, but are not found in single-celled organisms like bacteria. In fact, mitochondria are similar in both function and appearance to bacteria (almost like they are a smaller cell living inside of the cell). They even carry their own DNA, independent of the DNA found in the nucleus of the cell, and appear to replicate themselves independently from the cell. They also move about inside the cell to wherever they are needed for energy production.

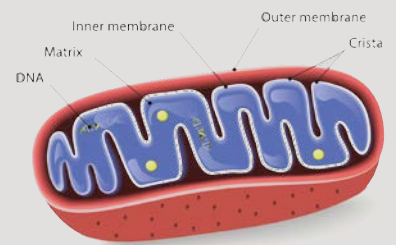
Tissues that are highly metabolically active, like those in the liver, brain, muscles and kidneys contain hundreds and even thousands of mitochondria in order to sustain their functions. If the number of mitochondria is reduced or there are problems with the func-

tion of these vital power plants, those cells will not have enough energy to do their jobs properly. This is known as mitochondrial dysfunction.

Chronic fatigue is a strong indication of mitochondrial dysfunction. Although a person can be temporarily fatigued by many things, long term chronic fatigue that is not relieved by rest means you should consider doing things to support your mitochondria.

The discovery of mitochondrial DNA has garnered scientific interest in genetic research because it is inherited exclusively from the mother. The human egg contains about 100,000 mitochondria, while the sperm cell contains about 100 and these appear to be destroyed after the egg is fertilized. As a result mitochondrial DNA is being used to trace maternal genetic lines.

It's also easier to identify someone from mitochondrial DNA. There are only two copies of the DNA in the nucleus but there are 5-10 copies of DNA in each mitochondria. As research continues in this field, we'll likely uncover many more interesting mitochondrial mysteries.



Mitochondrial Nutrition

Whole foods contain the nutrients mitochondria need to convert calories into energy. Deprived of these nutrients by diets of refined and processed foods, nutritional supplementation may help to restore their function along with a properly balanced diet. Here are some supplements to consider.

B-Complex vitamins, particularly thiamine (B1) and riboflavin (B2), are critical to the ability of mitochondria to extract energy from carbohydrates. The B-vitamins are so critical to carbohydrate metabolism that the FDA requires white flour to be “enriched” with thiamine, riboflavin, folic acid and niacin. Of course whole grains already contain these (and other) critical vitamins and minerals.

Refined sugar of course has not been “fortified” with any of these B-vitamins, which is why it rapidly contributes to mitochondrial dysfunction. So a good multiple vitamin containing B-vitamins like **Solstic 24** or **Super Supplemental** is absolutely essential to protecting the health of anyone eating refined carbohydrates.

Magnesium plays an important role in many functions, including energy production. Unfortunately, many people are deficient in this vital mineral and need at least 1-2 capsules of a supplement like **Magnesium Complex** everyday.

The amino acid l-carnitine draws fatty acid molecules into the mitochondria, where they are burned to produce energy. In doing so, the level of blood triglycerides is reduced. A deficiency of the amino acid l-carnitine can result in the buildup of fat in muscles, heart and liver. L-carnitine can be found with B-vitamins and other nutrients needed for energy production in **Solstic Revive**. It is also found in Cellular Energy (right).

Co-Q10 is responsible for transporting energy from one enzyme to another during cellular energy production. It is so critical that, even by itself, Co-Q10 can help with heart disease. The muscles of the heart have more mitochondria and need more Co-Q10 than other cells in order to keep on pumping continuously. Co-Q10 is also an antioxidant and reduces inflammation.

Alpha lipoic acid is an enzymatic cofactor essential in mitochondrial function, helping to maintain energy reactions and inhibit free radical damage. It is helpful for managing blood sugar levels and preventing nerve damage.

Another antioxidant that may help mitochondria is **N-Acetyl Cysteine**, which acts as a precursor to glutathione. Glutathione is an antioxidant that helps prevent mitochondrial damage.

Target Endurance contains minerals chelated to amino acids that deliver them directly to the energy-producing center (mitochondria) in cells, thus enhancing mitochondrial function. Research with animals showed this product to increase endurance levels by over 400 percent. These minerals are combined with B-vitamins, other nutrients and herbs that have also been used to improve stamina and endurance.

Additional Help and Information

For more information about mitochondria contact the person who gave you this newsletter. You can also consult the following resources:

The Comprehensive Guide to NSP by Steven Horne and Kimberly Balas

Sugar Toxic by Margit Silverman

Power, Sex and Suicide: Mitochondria and the Meaning of Life by Nick Lane



Cellular Energy

Cellular Energy is a blend of nutrients designed to support mitochondrial function. It can benefit aged and weak individuals, support recovery from chronic illness and debility, and aid athletes who wish to enhance physical performance. People who experience fatigue, lack of stamina or feelings of weakness may benefit from Cellular Energy.

Cellular Energy may also aid in recovery from other chronic and degenerative illness like neurological disorders, fibromyalgia and more by increasing the energy production necessary for healing. Here is a description of some of the ingredients.

Manganese, Zinc and Magnesium: These minerals are used to make enzymes that move each stage of the Krebs cycle forward. Enzymes are critical to energy production, because they act as catalysts to enable chemical reactions to take place at low temperatures. Different enzymes are required at each stage of the energy production cycle, and each stage must be finished before the next begins.

B-Vitamins: Vitamin B1 (thiamine mononitrate), vitamin B2 (riboflavin), niacin (as niacinamide) and pantothenic acid are essential to energy production in the cell. Thiamine is essential for the production of acetyl-coA from glucose and rapidly degrades in the body. Pantothenic acid is a constituent of Acetyl-coA. Riboflavin also plays a critical role in the Krebs cycle.

Alpha Lipoic Acid, L-Carnitine and Co-Q10: As described under the heading mitochondrial nutrition, these nutrients can be helpful for enhancing mitochondrial function. L-carnitine helps the mitochondria burn fats and both alpha lipoic acid and Co-Q10 serve as antioxidants to protect mitochondria.

Vitamin E: An antioxidant vitamin that protects the cardiovascular system, vitamin E also helps the body utilize oxygen at the cellular level.

Alpha Ketoglutaric Acid: This substance is used in the production of cellular energy in the citric acid cycle. It can be helpful in alleviating fatigue and increasing stamina. It helps in the formation of carnitine and helps detoxify ammonia from tissues of the central nervous system. Excess ammonia can cause headaches, migraines, fatigue, irritability and nausea. Alpha ketoglutaric acid also helps remove excess nitrogen from the system. It can be helpful in autism, exposure to toxic nitrogen compounds, liver disease and Reyes syndrome.

Dimethylglycine HCl is known as DMG for short. This substance has been used by athletes to improve oxygen utilization in exercise. It reduces muscle stiffness and soreness. It also supports the immune system and aids cellular detoxification.

Ferulic acid is an antioxidant compound found in many foods. There is some research suggesting it may enhance immunity and athletic performance.

The recommended dose of Cellular Energy is one capsule two or three times daily. Be sure to drink plenty of water with it.

This issue of *Sunshine Sharing* is provided by:

AskMara.com & Energy Wellness Products

Mara Gerke

9898 N 200 E, Decatur, IN 46733

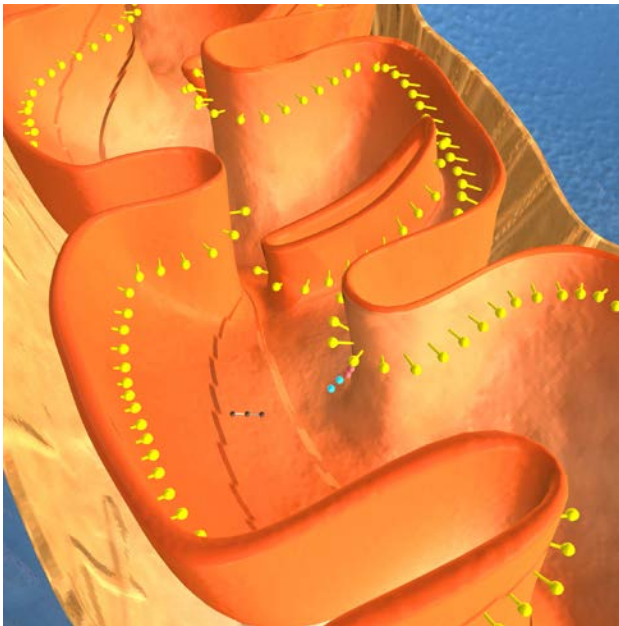
Phone: 800-728-2425

Website: <http://www.askmara.com/>

Email: askmara@gmail.com



Notice: This issue of *Sunshine Sharing* has been created for use by **AskMara.com & Energy Wellness Products** to send to their customers and NSP down-line. Printing for personal use is allowed. It is not permissible to modify this document or distribute it.



Power Up Your Cells by Enhancing Mitochondrial Function

Inside the cells of your body are tiny energy generating power plants called mitochondria. When these cellular power plants aren't working properly, you'll not only lose energy, you'll also be more prone to numerous chronic and degenerative diseases. Learn about your mitochondria and ways to keep them functioning properly in this issue of *Sunshine Sharing*.

Mitochondrial Power Plants Continued from page 2

stable level of glucose (blood sugar) to function properly. This is why blood sugar must be tightly regulated. If there is too much glucose it can chemically react with proteins and other substances and damage them. So, if the blood sugar is too high, the body moves glucose out of the blood using insulin to store it as glycogen or fat.

If blood sugar levels get too low, as happens in starvation or fasting, the brain has a hard time keeping your mind clear and your mood stable. So, there is a backup system called ketosis for supplying your brain and nerves with energy. In ketosis, the liver converts fats into ketones to produce acetyl-coA to supply energy for your brain.

A ketogenic diet severely limits carbohydrate intake, which forces the body into ketosis. Clinical evidence suggests that this is helpful for losing weight, controlling blood sugar levels, improving

mental focus, reducing hunger and increasing energy. Ketogenic diets may also help to reduce cholesterol levels and blood pressure, combat acne and even treat epilepsy. Research suggests they may also be helpful in treating cancer and neurological disorders.

On a ketogenic diet all sugary and starchy foods are eliminated, including sugary fruits and starchy vegetables like potatoes. The diet consists of meat, high fat dairy foods, non-starchy or low glycemic vegetables (like leafy greens and cruciferous vegetables), nuts, seeds, berries and quality fats like butter and coconut oil.

In a true ketogenic diet, about 70-75% of your caloric intake should come from natural (not processed) fats and 20-25% from protein, leaving only 5-10% of your caloric intake coming from carbohydrates. Modified ketogenic diets where 40% of calories come from fat, 30% from protein and the remaining 30% from fruits and vegetables are also beneficial for regenerating mitochondrial function and normalizing energy production and utilization.