



Food as Medicine

The Counseling Center at CELA

Mitochondria Strengthening Foods

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If you feel that you may have a mast cell disease (MCD), a mast cell activation related disorder, or environmental illness contact a qualified physician to receive medical help. The information present here is not medical advice and is in no way a substitute for receiving medical advice and treatment from a doctor.

Acknowledgement:

Thank you to the health professionals who have so generously shared their work on the internet. This booklet/ebook/pdf would not exist without your dedication, knowledge, giving spirit, and compassion.

Mitochondria

Mitochondria are located inside every single cell in the human body. The mitochondria produce energy and are often called the powerhouses of the cells. Mitochondria help turn the energy we take in through the food we eat into energy that our cells can use.

Mitochondria have several different roles in our bodies in addition to being the energy powerhouses of the cells, including regulating calcium and generating heat in our body through non-shivering thermogenesis.

When a mitochondria stops working, the cell that it is inside becomes starved of energy. Therefore, the symptoms a person may have when their mitochondria has become starved of energy and is no longer functioning can vary depending on what type of cell the mitochondria is within, (see <https://www.medicalnewstoday.com/articles/320875#disease>).

Symptoms of a mitochondrial disease vary greatly and might include:

- loss of muscle coordination and weakness
- problems with vision or hearing
- learning disabilities
- heart, liver, or kidney disease
- gastrointestinal problems
- neurological problems, including dementia

(<https://www.medicalnewstoday.com/articles/320875#disease>).

Other conditions thought to involve some level of mitochondrial dysfunction include:

- Parkinson's disease
- Alzheimer's disease
- bipolar disorder
- schizophrenia
- chronic fatigue syndrome

- Huntington's disease
- diabetes
- autism
- fibromyalgia
- Dercums disease
- Ehlers-Danlos Syndrome
- connective tissue diseases

(see Khan at lymphapress.com (2022) and medicalnewstoday.com/articles/320875#disease).

Mitochondria & Mast Cells

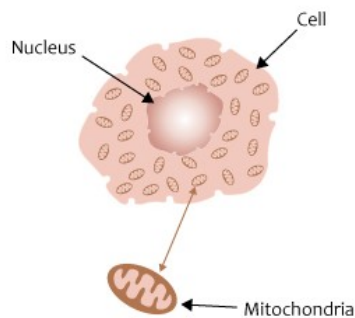
Mast cells play an important role in various inflammatory and allergic diseases. Mitochondria are actively involved in many stages of certain mast cell activation. Research has shown that when human mast cells degranulate, mitochondrial DNA and ATP are secreted extracellularly and are part of the inflammation response, (see <https://mastcellmaster.com/publications.php>). Without mitochondria, the human body would have no energy to keep it alive.

Recent studies have shown not only that mast cell activation leads to the secretion of extracellular mitochondrial particles, but also that mitochondrial components secreted from live cells can stimulate mast cells (Zhang et al, 2012).

One mitochondria component is adenosine triphosphate (ATP). ATP is a molecule that carries energy within the cells and is the main energy "currency" of the cells. It is an end product of the processes of photophosphorylation—adding a phosphate group to a molecule using energy from light—and cellular respiration. All living things use ATP. It is used in cell communication and is incorporated into DNA during DNA synthesis (<https://biologydictionary.net/atp/>).

A 2012 study at Tufts University in Massachusetts identified mitochondrial particles secreted from live, activated mast cells as a possible trigger for the body's inflammation process in many

illnesses. In the study, mast cells were stimulated by triggers secreted from nerves and, as a result, the mast cells secreted their inflammation-causing molecules—as well as some mitochondrial components. These mitochondrial components were secreted outside of the cell and into the extracellular fluid. The mast cells, however, retained their viability indicating that the secretion of the mitochondrial particles was not due to cell damage or cell death. The extracellular mitochondrial components then stimulated other skin cells to mount an auto-inflammatory response (see <https://now.tufts.edu/2012/12/17/mitochondrial-components-are-possible-trigger-auto-inflammatory-illnesses>). To quote Dr. T.C. Theoharides, senior author of the study, "Our work provides a possible explanation for inflammation that arises without apparent disease or injury."



Mitochondria Strengthening Foods

GLUTATHIONE

Supports mitochondria to help them neutralize free radicals produced during the generation of energy (Kahn, 2022).

- cruciferous vegetables (such as brussels sprouts, kale, cauliflower, cabbage, bok choy)
- watercress
- mustard greens
- garlic
- onions

- shallots
- poultry
- fish
- beef
- beans
- legumes
- strawberries
- citrus fruits
- kiwi
- bell peppers

Foods that give glutathione a boost:

- vitamin C
- turmeric
- whey protein

(see <https://www.livestrong.com/article/335859-food-sources-of-glutathione/>)

N-ACETYL CYSTEINE (NAC)

Gives antioxidant support and is essential for the formation of glutathione inside cells. NAC supports the immune system, nerve tissue, liver function, collagen formation, and lung tissue (Kahn, 2022).

- lentils
- oatmeal
- eggs
- low-fat yogurt
- sunflower seeds

- swiss cheese
- tuna
- lean chicken breast
- beef skirt steak
- lean pork chops
- garlic

(see <https://www.livestrong.com/article/531520-food-sources-of-n-acetyl-cysteine/>)

ALPHA-LIPOIC ACID

An antioxidant that is both water and fat soluble. It fights free radical damage, supports liver and nerve function, enhances antioxidant effects of vitamin C, vitamin E, and NAC (Kahn, 2022).

- red meats
- organ meats (such as liver, heart, kidneys)
- broccoli
- spinach
- tomatoes
- brussels sprouts
- potatoes
- green peas
- rice bran

(see <https://www.healthline.com/nutrition/alpha-lipoic-acid#sources-amp-dosage>)

VITAMIN C

Has antioxidant properties. When combined with other antioxidants offers a high degree of protection. Is an essential collagen supporter (Kahn, 2022).

- cherries
- plums
- rose hips
- chili peppers
- guava
- sweet yellow peppers
- cantaloupe
- parsley
- kale
- kiwi
- broccoli
- brussels sprouts
- lemons
- papaya
- strawberries
- oranges

(see <https://www.healthline.com/nutrition/vitamin-c-foods>)

CoQ10

Key component of the machinery responsible for producing energy within the mitochondria; neutralizes free radical damage to cellular and mitochondrial membranes (Kahn, 2022). CoQ10 is an antioxidant that the human body produces naturally. Cells use CoQ10 for growth and maintenance (see <https://www.mayoclinic.org/drugs-supplements-coenzyme-q10/art-20362602>).

- oily fish (such as salmon, mackerel, sardines)
- eggs
- nuts

- chicken
- organ meats (such as liver, heart, kidneys)
- whole grains

(see <https://health.clevelandclinic.org/what-is-coq10/>)

And also:

- soybeans
- vegetables

(see <https://www.livestrong.com/article/256149-what-foods-are-rich-in-coq10/> and <https://www.mayoclinic.org/drugs-supplements-coenzyme-q10/art-20362602>)

GLYCINE

An amino acid that helps build proteins needed for tissue and hormone maintenance. Glycine may help support heart and liver health, improve sleep, reduce diabetes risk, and reduce muscle loss. The body naturally produces glycine from other amino acids but it is also found in protein-rich foods. Glycine is also a powerful antioxidant that helps protect your body from oxidative damage caused by free radicals (see <https://www.healthline.com/nutrition/glycine/>).

- bone broth
- beans
- vegetables (such as spinach, broccoli, kale, cauliflower, cabbage, pumpkin)
- fruits (such as bananas, kiwi)
- meat
- dairy products
- poultry
- eggs
- fish

(see <https://draxe.com/nutrition/glycine/>)

NICOTINAMIDE RIBOSIDE (NR)

An alternative form of vitamin B3 (also called niacin.) NR is converted by the human body into nicotinamide adenine dinucleotide (NAD+). NAD+ is a coenzyme or helper molecule. NAD+ acts as fuel for many important biological processes such as: converting food into energy; repairing DNA that has been damaged; fortifying the cells' defense systems; setting the body's inner clock or circadian rhythm. Low NAD+ levels have been linked to such health issues as: aging; diabetes; heart disease; Alzheimer's disease; vision loss (see <https://www.healthline.com/nutrition/nicotinamide-ribose#what-it-is>):

- dairy milk
- yeast

(see <https://superfoodly.com/nicotinamide-ribose-food-sources/>)

NAD+

An energy carrier molecule. It is the most important cellular co-factor for improving mitochondrial number and function (Kahn, 2022). NAD+ is essential to cell function, energy, and resilience. The human body works to replenish it by either recycling NAD+ used up in the cells or by making it using nutrients the body takes in through the food we eat and supplements (Longevity Collective, 2023).

- fish (tuna, anchovies, salmon)
- dairy milk
- pork
- beef
- turkey
- whole grains

(see <https://www.longevitycollective.com/boosting-nad/foods-rich-in-nad>)

RESVERATROL

A polyphenolic phytoalexin viewed as an antioxidant, antii-inflammatory, anti-apoptotic, and anticancer agent. Resveratrol has been reported to modulate mitochondrial function and to lessen mitochondrial impairment induced by certain stressors (Jardim et al, 2018). Brain cells are susceptible to mitochondrial dysfunction due to their high demand for ATP and they

consume oxygen at very high rates, therefore, strategies focusing on the maintenance of mitochondrial function are of interest especially with neurodegenerative diseases that involve mitochondrial impairment (Jardim et al, 2018).

- grapes
- berries
- peanuts
- red wines

GLYMPHATIC SYSTEM AND BRAIN SUPPORTING FOODS

A recently discovered system for waste clearance in the brain. It may also function to help distribute non-waste compounds such as glucose, lipids, amino acids in the brain. The glymphatic system functions mainly during sleep and is largely disengaged during wakefulness (Jessen et al, 2015).

- fruits
- vegetables
- nuts
- seeds
- cooked leafy greens
- dark chocolate
- avocado
- foods rich in magnesium

(see <https://www.mindbodygreen.com/articles/how-to-detox-your-brain-by-optimizing-your-glymphatic-system>)

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