

Mitochondrial dysfunction: a cause and symptom of chronic illness.

By: Andrew P Litchy, ND

Mitochondria are “cellular power plants.” They are found in nearly every cell of our bodies, and they help make the energy we need to move, think, and live. When our mitochondria are healthy, our body can function well. However, there are many problems associated with dysfunctional mitochondria. Aging, autism, diabetes, heart disease, fibromyalgia, chronic fatigue syndrome, schizophrenia, and depression are common issues that are associated with mitochondrial dysfunction (1). As we learn more about how to address mitochondrial dysfunction, we find ways to help common diseases and also help us live healthier, happier, and possibly longer.

Mitochondria basics

Mitochondria are small: thousands of mitochondria can fit inside one muscle cell. However, they are the core of metabolism, and the reason why we need oxygen to live. Mitochondria use oxygen to create energy the body needs.

Mitochondria are quite delicate. Inside each tiny mitochondrial are several layers of membranes. These membranes need to be intact for the mitochondria to function well. However, lack of antioxidants, problematic diet choices, genetic mutations, and certain diseases can lead to these membranes being damaged. When these membranes are damaged, the function of the mitochondrial is compromised. Energy production can decrease, and resulting toxic byproducts can wreak havoc on the body.

Mitochondrial dysfunction contributes to a range of neurodevelopmental and neurodegenerative diseases. Without adequate energy production, the brain cannot function, muscles are weaker, and many symptoms cannot develop normally. Lack of energy production is one reason why mitochondrial dysfunction is associated with such a variety of seemingly unrelated medical conditions.

Common symptoms of mitochondrial dysfunction include chronic fatigue, difficulty concentrating, loss of motor control, muscle weakness and pain, gastro-intestinal disorders and swallowing difficulties, poor growth, cardiac disease, liver disease, diabetes, respiratory complications, seizures, visual/hearing problems, lactic acidosis, developmental delays and susceptibility to infection(1). People with dysfunctional mitochondria may have dramatic symptoms, others may only have issues with fatigue or chronic infections.

Why does mitochondrial dysfunction develop?

There are many reasons why people develop mitochondrial dysfunction. A common reaction is genetic susceptibility, or damage to the genetic code. Also, certain diseases stress the mitochondria, and may cause dysfunction to develop in addition

to the first problem. It can be difficult to determine if mitochondrial dysfunction was the first problem, or a result of previous problems. We do not fully understand every reason why people develop mitochondrial dysfunction, however, we do know risk factors, and how damage can happen.

Environmental Influence

Pollution and toxins negatively affect mitochondria. Smoke, car exhaust, pesticides, heavy metals, and even artificial flavorings can all damage mitochondria. These substances may be impossible to avoid, and for most people they are a stressor that the body can cope with. However, certain people are particularly vulnerable to these toxins, and exposure can cause or exacerbate mitochondrial dysfunction. Genetic testing may reveal who is most at risk for complications. Pesticides from nonorganic food can cause problems, and heavy metals or plastics that enter our food and water supply can cause damage as well.

Oxidative Stress

Free radicals, or reactive oxygen species, can harm mitochondria. It is normal to produce free radicals in day-to-day living, and the body is able to heal from this stress under normal conditions. Breathing and exercise produce free radicals, as do other normal bodily functions. However, excess amounts of free radicals are associated with many chronic diseases and DNA damage. Too many free radicals at one time and/or inadequate dietary sources of antioxidants can lead to damage to the membranes of the mitochondria. This can be a vicious cycle. When there are too many free radicals, it can damage portions for DNA that code for ways to repair mitochondria and heal free radicals. Then, the number of free radicals increases further and significant mitochondrial dysfunction can develop.

Gastrointestinal Concerns

Gastrointestinal function is important to the health of mitochondria. A healthy balance of bacteria in the intestines is important for all aspects of health, however, unhealthy bacteria balance can be particularly harmful to mitochondrial function. When there is dysbiosis, or an imbalance in intestinal bacteria, damaging metabolites from these bacteria can accumulate and interfere with normal metabolism. For example, high levels of *Clostridia* in human intestinal tract can lead to elevated amounts of propionic acid in the blood and urine. High levels of propionic acid cause mitochondrial dysfunction, and is also associated with autism and behavioral problems like hyperactivity, poor concentration, and social problems (2).

Identifying issues

Certain symptoms can help determine who would benefit from treating mitochondrial dysfunction. When the mitochondrial dysfunction is severe, there are

usually marked and impossible to miss symptoms. In infants and children, failure to meet developmental milestones, weakness, and cognitive problems may be red flags. Conditions like Parkinson's disease, autism, and certain neurological conditions are often associated with mitochondrial dysfunction, and intricate workups are standard of care in these cases. However, sometimes the symptoms are more generalized and less specific, and so clinicians may not consider mitochondrial health. Muscle weakness, easy fatigability, chronic pain, gastrointestinal problems, mood and cognition issues, and having an undiagnosable condition all may be related to a degree of mitochondrial dysfunction. Traditionally, disorders like mitochondrial dysfunction are thought to be severe, highly neurologically disruptive diseases. However, we are finding that there is a spectrum of mitochondrial dysfunction, ranging from no neurological manifestations to life-threatening complications.

There is no reliable lab test that can identify all cases of mitochondrial dysfunction. An appropriate workup is usually extensive, however, there are some tests that can serve as screening tools. A comprehensive blood and urine test for organic and amino acids, and the activity levels of certain enzymes can yield extremely useful information. Genetic testing can be helpful, and is an increasingly important part of helping people with chronic diseases. Biochemical markers of mitochondrial dysfunction described in the literature include direct (lactate, pyruvate, lactate-to-pyruvate ratio, ubiquinone, alanine, alanine-to-lysine ratio and acyl-carnitine) and indirect markers (creatine kinase (CK), carnitine, aspartate aminotransferase (AST), alanine aminotransferase (ALT) and ammonia) (3).

There is a growing evidence base on how to diagnose mitochondrial dysfunction that happens at the same time as other conditions. For example, elevated lactate and gastrointestinal problems are common in both autism and mitochondrial dysfunction, so it is important to consider other markers such as pyruvate to make a clear recommendation. Furthermore, one meta-analysis of mitochondrial dysfunction and autism reported that of the 68 studies analyzed, there was not a single case of autism with simultaneous mitochondrial dysfunction that presented with like a classic mitochondrial syndrome (3). Without experience in both autism and mitochondrial dysfunction, it is difficult to make an appropriate diagnosis.

Diagnosing mitochondrial dysfunction can be complicated, and is based on objective clinical, histological, biochemical, molecular, neuroimaging and enzymatic findings. Due to the innate complexity of this issue and the rapidly advancing/changing evidence base, effective diagnosis and treatment should be conducted by a qualified health professional who has experience with both mitochondrial dysfunction and any other problems that are happening at the same time.

Healing mitochondria

Mitochondrial dysfunction is a complex issue. It has many causes and may be intertwined with other problems. Strategies to treat mitochondrial dysfunction effectively will vary from individual to individual. However, there are some general guidelines that may be of benefit to people who suspect they are experiencing mitochondrial dysfunction.

Therapeutic diet choices are extremely helpful. Eating a variety of antioxidant rich foods will help reduce damage to mitochondria, and can help improve their function (4). Brightly colored fruits and veggies have high anti-oxidant contents, and are recommended. Healthy fats are also recommended, and can help mitochondrial function (5). Wild caught deep sea fish and organic nuts and seeds are good sources of healthy fat.

Minimizing contact with known stressors to mitochondria is helpful. Avoiding exposure to pollution, stress, and toxic substances is instrumental to healing. Eating organic foods, avoiding plastic food and beverage containers, and staying away from process foods and food additives are great ideas. Drinking filtered water and avoiding water stored in plastic can also be helpful.

Developing a regular sleep schedule with at least 8 hours of rest is helpful for addressing mitochondrial dysfunction. Meditation or prayer practices can improve your ability to handle day-to-day stresses, and offer a chance for deep relaxation. Improving rest and reducing stress may not cure the cause of mitochondrial dysfunction, however, both allow the body to heal. Without adequate rest and stress reduction, it can be challenging to fully recover.

Cultivating a healthy digestive system will also help mitochondria. Eating adequate fiber, enjoying probiotic foods like yogurt, drinking plenty of clean water, eating at regular intervals, and avoiding processed foods is a great start(6). However, if digestive problems remain even when following these suggestions, one may need to consult a healthcare provider.

Certain herbs, supplements, and vitamins will improve mitochondrial function. However, due to the complexity and various causes of mitochondrial dysfunction, following generic protocols and trying random products are highly discouraged practices. Careful diagnosis and individualized treatment from a healthcare provider experiences with mitochondrial dysfunction will not only be more effective than random or internet-guided interventions, but it will save money and help avoid side effects from ill advised treatments.

Mitochondrial dysfunction can be debilitating, and may complicate an already complex illness. However, with appropriate diagnosis and treatment, there is a great deal that can be done to improve quality of life and address the root causes of mitochondrial dysfunction.

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Bio:

Andrew Litchy, N.D. is a graduate of the National College of Natural Medicine (NcNM) in Portland, OR. While attending NcNM, Andrew also received a Certificate in Shiatsu massage. During his time at NcNM, he conducted research studying the effects of meditation training on the body and mind and has presented this work at national and international meetings. Prior to attending NcNM he received the Bachelor of Arts degree in Physiology from the University of Minnesota (Twin Cities). Andrew's research interests include the physiologic correlates of mind-body training, botanical and homeopathic medicines, and traditional naturopathic interventions.

Currently, Andrew practices naturopathic medicine at the Bhakti Wellness Center in Edina, MN. He is adjunct faculty at the National College of Natural Medicine where he teaches Lifecycle Nutrition and pathophysiology in the MScN program, and is teaching faculty at the University of Minnesota where he teaches Lifestyle Medicine. Andrew is the Treasurer for the Minnesota Association of Naturopathic Physicians, and is a medical supervisor at Pillsbury House Integrated Healthcare Clinic.

Andrew is an endorsed Samatha-Vipassana meditation instructor and was previously a Buddhist monk. He leads several meditation groups in the Twin Cities, and volunteers teaching Loving-Kindness meditation at Pathways in Minneapolis, MN.

When not in the clinic, Andrew can be found with his son on his knee, both plunking away at the piano. He is an avid gardener and cook, and is owned by two lovely cats.

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