

Mitochondrial Medicine: A Practitioner Guide

This guide is all about mitochondria and their role within the body. It explores mitochondrial dysfunction and its:

- associated conditions
- causes
- testing options
- therapeutic considerations for mitochondrial repair

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What are mitochondria and what do they do?

Mitochondria are an integrative part of sustaining human life, through energy production and intracellular signalling. They're often described as the 'powerhouse of the cell' as they produce ATP, the energy currency of the cell.

However, they also sense, integrate and signal information about our environment, and so regulate a huge variety of processes in many different systems within the body.

Mitochondria play a key role in regulating our circadian rhythm, metabolism, intestinal microbiota and immune response, as they are closely interconnected with all of these systems.

It's thought that 10% of the human body is mitochondria, so it's hardly surprising they play such a key role in many different functions.

Mitochondria as 'harvesters of sunlight as energy from food'

In Ray Griffith's book, *Mitochondria in Health and Disease*, it addresses how mitochondria use sunlight as energy within the body.

On one level, we know we extract vitamins and minerals from food, which are required for mitochondrial function. However, actual energy production involves electrons, as it is dependent on electrons flowing down the electron transport chain.

The energy of photons from sunlight excites electrons and so becomes embedded in organic compounds (e.g. plant foods) which become our energy source, and in this way, energy from sunshine is pumped into our bodies by our mitochondria.

Mitochondria in Health and Disease [[Amazon](#)] provides research that is so valuable for helping clients with mitochondrial dysfunction, as it shows we mustn't underestimate the value of getting outside as much as we can.

Mitochondria and gut health

An article published in 2020 [[Nature Microbiology](#)] shows that mitochondria influence microbiome diversity, and help to regulate our immune response to pathogens at the gut lining. Mitochondria appear to monitor the gut lining and the immune cells found there, as they provide energy for the immune cells to act against any pathogens when they present at the gut lining.

This article also highlights that antibiotics are as harmful to our mitochondria as they are to our microbiota.

Mitochondria and exercise

A piece of research published in 2017 [[PubMed](#)] shows us that the potential effects of exercise depend on how well-equipped our bodies are to gain from it. This means how optimal our mitochondria are, and how easily they produce free radicals. This is determined by our maternal mitochondrial DNA, and also the individual's overall state of health.

This can be helpful when working with clients who may suffer from conditions such as fibromyalgia and chronic fatigue syndrome (CFS), as it helps to inform us on the mechanisms of exercise and how it can help energy levels.

Mitochondria and adaptation & energy

Mitochondria dictate our ability to adapt to our environment, as identified in research published in 2018 [[ScienceDirect](#)]. They produce steroid hormones, cholesterol and energy production; energy in particular is fundamental to help us adapt, as without it stressors would have no effect on us.

It's worth considering how people suffering from depression and CFS often show apathy; they don't have the energy to mount a response. It could therefore be helpful to consider the role of mitochondria in these cases.

Mitochondria and respiratory & cardiovascular health

Recent research from 2021 [[ResearchGate](#)] shows a link between the mechanisms of mitochondrial dysfunction and respiratory health, and research from 2020 also highlights the link between mitochondria and cardiovascular health [[PubMed](#)]. This can potentially provide valuable therapeutic interventions for respiratory and cardiovascular diseases through targeting dysfunctional mitochondria.

Conditions associated with mitochondrial dysfunction

- Neurological disorders & autism
- Renal diseases
- Dystrophies
- Ageing
- Vascular diseases & atherosclerosis
- Pulmonary & respiratory disorders
- Neurodegenerative diseases
- Cardiac diseases
- Cancer
- Mitochondrial diseases
- Metabolic disorders & diabetes
- Skeletal muscle & movement disorders

Causes of mitochondrial dysfunction

The following can all compromise ATP, increase lactic acid and cause metabolic dysfunction:

- Chronic systemic inflammation
- High amounts of catabolic stress
- Gastrointestinal dysfunction (SIBO, leaky gut)
- Metabolic dysfunction (insulin resistance)
- Loss of muscle mass and function
- Energy and protein deficit

Systematically speaking, the causes of mitochondrial impairment can often arise from:

- Nutrient deficiencies
- Carbohydrate excess
- Toxin exposures
- Microbial colonisations

Testing options for mitochondrial function

- Organic Acids Test
- Gut Microbiome Test
- Leaky Gut Test
- SIBO Test
- GPL-TOX
- Metabolomix
- Cyrex Array 7
- Oxidative Stress 2.0
- Metabolic Syndrome Profile
- Interleukin 17
- Methylation Panel

Dietary interventions for mitochondrial repair

The fundamental interventions to improve mitochondrial dysfunction are improving sleep quality, regular exercise, stress management and eating a healthy, balanced and seasonal diet.

Research suggests more specific dietary interventions may include:

- Ketogenic diet
- The Wahl's Protocol
- Low-FODMAP diet
- Mediterranean diet
- Swank Diet (multiple sclerosis)
- Modified Mediterranean Keto Diet
- The MIND Diet (related to vitamin K)

Of course, it is important to pick the most suitable diet based on the individual and their needs.

Nutrient-specific interventions for mitochondrial defence

- Oleic acid
- omega 3
- vitamin B
- vitamin C
- polyphenols
- lycopene
- OSCs (Organosulfur Compounds)

Lifestyle interventions for mitochondrial repair

- Exercise
- Grounding (earthing)
- Sauna therapy
- Photobiomodulation
- Breathwork (breathing properly needs provide oxygen to mitochondria)
- Melatonin

References:

- [*Mitochondria in Health and Disease*](#), Ray Griffiths, 2018
- [*Mitochondrial dysfunction caused by outer membrane vesicles from Gram-negative bacteria activates intrinsic apoptosis and inflammation*](#), Pankaj Deo et al, 2020
- [*The Crosstalk between the Gut Microbiota and Mitochondria during Exercise*](#), Allison Clark & Núria Mach, 2017
- [*An energetic view of stress: Focus on mitochondria*](#), Martin Picard et al, 2018
- [*Mitochondrial Dysfunction in Chronic Respiratory Diseases: Implications for the Pathogenesis and Potential Therapeutics*](#), Wen-cheng Zhou et al, 2021
- [*The role of mitochondria in cardiovascular diseases related to atherosclerosis*](#), Victor Yu Glanz et al, 2020