Optimising mitochondrial function: energy and healthy ageing

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**THE MITOCHONDRIA**

Mitochondria play host to one of the most important processes in your body: **cellular respiration**. Taking in glucose and oxygen, mitochondria produce energy which they capture and package as energy-rich molecules of adenosine triphosphate (ATP).

In addition to energy production, mitochondria have been implicated in various metabolic and cellular processes including:

- Production of reactive oxygen species (ROS)
- Cell repair
- Cell signalling
- Cell growth
- Ageing

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**MITOCHONDRIAL DYSFUNCTION**

When the mitochondria fail, less and less energy is generated within the cell resulting in fatigue, memory loss, pain, ageing, cell injury and even cell death. If this process is repeated, whole systems may begin to fail and mitochondrial dysfunction may progress to mitochondrial disease.

Due to the high energy requirements of the brain and muscles, mitochondrial disease typically affects these parts of the body. Other organs which are frequently affected include heart, liver, kidneys and the endocrine system.

Research suggests damaged mitochondria play a role in an array of degenerative illnesses ranging from diabetes and neurological disorders to heart disease.

**MITOCHONDRIAL DAMAGE**

Causes of mitochondrial damage:

- Oxidative stress
- Genetics
- Toxins
- Infections
- Stress
- Overeating

**WHAT HAPPENS IN THE CELL: ENERGY PRODUCTION AND OXIDATIVE STRESS**

**Nutritional Support for Mitochondrial Energy Production**

- **Coenzyme Q10 (CoQ10)**
  - Essential role in the electron transport chain
  - Free radical scavenger
  - Deficiency associated with subnormal or pathological mitochondrial damage
  - Membrane stabiliser

- **Magnesium orotate**
  - Magnesium - Critically involved in synthesis of ATP
  - Activates ATP
  - Orotate - Stimulates synthesis of ATP
  - Facilitates transport of magnesium into cell and inner mitochondrial membrane

- **L-carnitine**
  - Conjugates fatty acids for transport across the inner mitochondrial membrane
  - Modulates oxidation rates of fatty acids
  - Transports toxic compounds out of mitochondria
  - Supports healthy membrane function
  - Reduces mitochondrial decay

- **Alpha-lipoic acid**
  - Collector for several mitochondrial enzymes
  - Hydrophilic antioxidant
  - Has regenerative effect on mitochondria
  - Optimises mitochondrial function and reverses cell ageing

- **B vitamins**
  - B1, B2, B3 required in Kreb’s cycle and electron transport chain
  - Biotin is essential for regulating mitochondrial fatty acid oxidation

**REDOX SIGNALLING**

**MITOCHONDRIAL DYSFUNCTION**

**APOPTOSIS/ NECROSIS**

**DISEASE AND AGING**

**ATP**

**KREBS CYCLE**

**ELECTRON TRANSPORT CHAIN**

**ROS** (Reactive oxygen species; ATP: adenosine triphosphate; ADP: adenosine diphosphate; NADH: nicotinamide adenine dinucleotide; FADH: flavin adenine dinucleotide; e⁻: electron; H⁺: hydrogen ion; P⁻: inorganic phosphate)