

TOTAL MITOCHONDRIA

Ingredients: Vitamin E (succinate) 45 i.u, Vitamin C (as ascorbate) 44.4 mg, Vitamin B-1 15 mg, Niacin 5 mg, Folic Acid 250 mcg, Selenium (as chelate) 34 mcg, Manganese (as chelate) 83 mcg, Zinc (as chelate) 500 mcg, Copper (as chelate) 10 mcg, Magnesium (as malate) 11.25 mg, Sodium (as ascorbate) 6.55 mg, Niacinamide 10 mg, Vitamin K (phylloquinone) 6 mcg, Alpha Lipoic Acid 15 mg, Co-enzyme Q-10 10 mg, Acetyl L-Carnitine 10 mg, N-Acetyl Cysteine 10 mg, L-Glutathione 10 mg, SOD Type G 250 i.u, (Glutathione 250 i.u., Catalase 781 i.u.), L-Tyrosine 10 mg, L-Glycine 10 mg, L-Glutamic Acid 10 mg, Phosphatidylserine 2 mg, Lecithin (50 mg of Phosphatidylcholine) 109 mg, Catechin extract 75 mg.

Supportive Function: Nutritional support for the efficient production of energy. The mitochondria are called the “powerhouses of the cell” because it is in the mitochondria that our energy is made. The energy we need for everyday biochemical reactions and existence is derived from ATP, the currency for energy that is produced in the mitochondria of every living cell in the Krebs’s cycle. Protecting the mitochondria from damage is believed to help prevent the cell from aging.

When is mitochondrial support helpful? Total Mitochondria is suggested in any instance where energy support is indicated, such as fatigue, chronic fatigue, Fibromyalgia, exercise training, etc., and also where support of the anti-aging process is indicated.

Clinical Applications/Research: The mitochondria have the unique ability to make ATP, which is the energy that fuels virtually every biochemical function in the body, from protein synthesis and muscle contraction, to digestive enzyme production and nerve conduction. ATP is like an energy exchange, just like we use dollar bills for a money exchange. Without ATP, we would not have the energy to maintain normal function. The mitochondria accomplish this energy production by using electrons, derived from the carbohydrate, fat, and protein in our food, to produce ATP. When we lose energy from not being able to produce ATP, we see everything from muscle wasting, fatigue, energy loss, sleep disturbances, and impaired cognitive function. The aging of the mitochondria is one of the major theories of what causes the aging of our bodies.

The mitochondria produce energy by being able to convert the electrons from our food into usable energy. The electron transport system, which utilizes Co-enzyme Q-10 as a major electron carrier, provides for the change in the energy of electrons to the energy of ATP production. Carnitine, which brings the fatty acids across the mitochondrial membrane for oxidation, facilitates energy production by providing the electrons from the fat to make ATP. It is also believed to play an integral role in branched chain amino acid metabolism (Shils M & Young V, eds. *Modern Nutrition in Health and Disease*. 7th ed. 1988. Lea & Febiger, Philadelphia, Pa. p.453.), which has been studied for its role in exercise performance. Vitamin C is needed for carnitine synthesis, and the symptoms such as fatigue that are seen in vitamin C-depleted human volunteers may actually be the result of poor energy production due to decreased carnitine biosynthesis" (Ibid, p. 422.) This is one of the reasons that carnitine supplementation, along with Co-enzyme Q-10, vitamin

E, and B-complex, are discussed for their therapeutic effects in Duchenne muscular dystrophy and conditions of mitochondrial defects (Scholte HR et al., "Carnitine deficiency, mitochondrial dysfunction and the heart. Identical defect of oxidative phosphorylation muscle mitochondria in cardiomyopathy due to carnitine loss and in Duchenne Muscular Dystrophy". *Wiener Klinische Wochenschrift*. January 6, 1989; 101(1): 12-17.) It is possible that chronic fatigued patients may have impairment of mitochondria and the oxidative metabolism that produces energy. (McCully, KK et al., Use of exercise for treatment of chronic fatigue syndrome. *Sports Medicine*, January 1996; 21 91): 35-48.)

Magnesium (as malate): Magnesium combines with lactic acid, neutralizing the negative effect of excess lactic acid, normalizing breathing for asthma, emotional disturbances, and restoring the ill health of people in many disease conditions (Reich C, "Calcium and Vitamin D Deficiency," *The Arthritis Trust*, www.arthritis-trust.org). Magnesium is needed in the oxidation of fats into energy; essential for muscle contraction and relaxation, nerve health, normal blood pressure and heartbeat; helps build muscle. Szent-Gyorgyi found that malic acid (malate) stimulates cells into using oxygen to produce its energy, signaling the mitochondria to use oxygen to burn food as fuel, its most efficient mode of energy production. Malate has been used for CFS/CFIDS and FM to improve energy and reduce pain. ("Open Your Mind to the Possibilities," *CFIDS Chronicle*, Summer 1993; Lehninger A, *Principles of Organic Chemistry* (1982): 399, 400, 442; Lininger, et al, 1998:54). *Caution: Kidney disease patients should take magnesium only under supervision of their doctor.*

Co-enzyme Q-10 is a necessary catalyst in the creation of all energy that cells need for life. It is a major electron carrier in the production of ATP energy. Low levels of Co-Q-10 are associated with aging and nearly all disease states. It has been used successfully to improve the health of people with hypertension and heart disease, those undergoing chemotherapy, in diabetes, infertility, and gum disease. It has been reported to have anti-aging effects and to significantly boost the immune system (Lininger, et al, 1998:152; Bliznakov, 1987; Balch & Balch, 1997: 43). Co-enzyme Q-10 has been used therapeutically in conditions of mitochondria defects and Duchenne muscular dystrophy (Scholte HR, et al, "Carnitine deficiency, mitochondrial dysfunction and the heart. Identical defect of oxidative phosphorylation muscle mitochondria in cardiomyopathy due to carnitine loss and in Duchenne Muscular Dystrophy," *Wiener Klinische Wochenschrift* Jan. 1989; 101(1): 12-7).

Alpha Lipoic Acid plays a key role in converting food into energy in the mitochondria. It enhances the antioxidant functions of Vitamins C, E, and glutathione (Balch & Balch, 1997:43).

Acetyl L-Carnitine transports fatty acids across the membranes of the mitochondria where they can be used as sources of fuel to produce energy. Muscle weakness, extreme fatigue, and excess storage of fat in muscles have been reported to be common signs of L-Carnitine deficiency. Supplementation has reduced blood lipids by 50% and liver fat levels significantly. Carnitine supplementation has been reported to increase levels of ATP in heart muscle, to benefit heart strength, angina, and arrhythmia, and to lower blood lipids and triglycerides. Carnitine helps increase physical performance and appears to have an anti-fatigue effect in both animals and humans (Chaitow, 1988:75-7; Leibovitz, 1984: 109; 169; 171; 201; 207).

Vitamin C is necessary for the body to synthesize carnitine. Deficiencies of vitamin C have been associated with extreme fatigue linked to poor energy because of decreased carnitine synthesis (Shils M and Young V, eds, *Modern Nutrition in Health and Disease*, 7th Ed., Philadelphia, PA: Lea & Fibiger, 1988:453).

Vitamin E and B Vitamins have been successfully used in therapy for conditions of mitochondria defects and Duchenne muscular dystrophy (Scholte *Ibid.*). B Vitamins are necessary for the mitochondria to produce energy from carbohydrates in the Krebs's citric

acid cycle. FM patients have been found to have low B-1 status and reduced activity of B-1 dependent enzymes.

Folic Acid is lost in food processing; folic acid alleviates pain; promotes antibody activity, cellular division, and is necessary for utilization of sugars and protein.

Niacin, Niacinamide (B3) can increase energy by properly utilizing food; necessary for healthy digestion, nervous system, and brain functions.

Vitamin K deficiencies are found in people with malabsorption problems. K increases resistance to infection; is necessary for converting and storing glucose energy as glycogen in the liver; promotes healthy liver function (Balch & Balch, 1997:20).

Vitamin E provides antioxidant protection against mitochondria damage and aging of cells. Positive to dramatic benefits have been achieved with E supplementation in FM (Lininger et al, 1998:54; 222; Mindell, 1985: 55; 60-1).

Glutathione, N-Acetyl Cysteine has antioxidant properties that protect mitochondrial cells against aging and cell death (Yamaguchi, et al, "Selenium concentration and glutathione peroxidase activity in plasma and erythrocytes from human blood," *J of Clin and Biochem Nutri* 1992; 12:41-50).

Selenium is necessary to activate glutathione. Deficiency is linked with loss of stamina; synergistic with E in protecting cells from aging and hardening; necessary to activate thyroid hormones.

Manganese is needed for the formation of thyroxin, the major hormone of the thyroid; essential for conversion of food into energy. Manganese helps eliminate fatigue; is an essential part of Mn SOD, which protects the mitochondria; aids muscle reflexes; improves memory; reduces nervous irritability (Mindell, 1985: 88-9; 83; Balch & Balch, 1997:45).

Sodium (as ascorbate) is a buffered form of Vitamin C that is easier on the stomach. Sodium itself helps keep other minerals soluble in the blood; helps nerves and muscles function properly. Low sodium intake has been linked with fatigue and with impaired carbohydrate metabolism (Mindell, 1985: 90-1).

Phosphatidyl Serine and Lecithin (Phosphatidyl Choline) help transport lipids across cell membranes to reach the mitochondria and support the fluidity and integrity of cell membranes of the mitochondria. They help support both energy creation and brain function.

Zinc helps promote energy production, resistance to infections, regulation of blood sugar; protects against free-radical damage to cells and promotes tissue repair (Lininger et al, 1998: 14; 224).

Copper is essential to make ATP (adenosine triphosphate), the energy molecule the body needs to run on. Copper and Zinc are also necessary parts of SOD, super oxide dismutase, which protects and revitalizes cells (Balch & Balch, 1997:45).

L-Tyrosine is a mood elevator and a precursor to active thyroid hormone. Deficiency symptoms include low body temperature and restless legs. Supplementation can be helpful against chronic fatigue. **Caution:** *should not be taken with MAO inhibitor drugs* (Balch & Balch, 1997:42).

L-Glycine in proper amounts produces more energy in the body, retards muscle degeneration, and is essential to the formation of DNA and RNA, bile, gastric acid, and glutathione (Balch & Balch, 1997: 39; Chaitow, 1988:83-4).

L-Glutamic Acid helps metabolize sugars and fats, detoxifies ammonia from tissues, and converts into glutamine. Glutamine prevents muscle wasting, helps build and maintain muscle health; helps fuel the brain; enhances mental function; and enhances energy in treating chronic fatigue (Balch & Balch, 1997:38-9).

Catechin Extract has been reported to enhance energy levels in chronic fatigue, has very powerful antioxidant protection, has antiviral and antibacterial inhibiting properties especially against *H. pylori*, and promotes ulcer healing (Lininger et al, 1998:104; 140; Konlee M, "Free radicals in HIV progression: pycnogenol reverses their effects," *Townsend Letter for Doctors*, Dec. 1994).

Testimonials/Nutrient Tidbits: “The patient started taking Total Mitochondria and now feels great and finally has energy!” (Kristi Campbell, D.C.)

Suggested Dosage: 1-2 tablets 3 times daily or as directed

Size: 90 tablets

Vegetarian: Yes

Contraindications: Tyrosine should not be taken with MAO inhibitor drugs. Liver disease patients should take magnesium only under the supervision of a doctor.