



## Cellular Energy

Stock #1879-6 (60 capsules)

Cellular Energy is a nutritional supplement designed to increase energy production within the cells, thereby promoting a greater sense of health and vitality. Cellular Energy contains a unique blend of vitamins, minerals and nutrients that are essential for healthy metabolism and energy production, as well as powerful antioxidants that protect the cells against oxidative damage, which not only results from aging and age-related diseases, but which also contributes to the very process of cellular and tissue aging.<sup>1</sup>

Fatigue is a common symptom reported by as many as 20% of patients seeking care from primary care physicians in the U.S. Common causes of fatigue include B-vitamin deficiency anemias (a shortage of red blood cells), as well as deficiencies of nutritional co-factors involved in the production of adenosine triphosphate (ATP), the molecule that provides energy for the cells. Patients with chronic fatigue syndrome often exhibit shortages of these essential co-factors, such as B-vitamins, and frequently demonstrate

low blood serum levels of acetyl-L-carnitine, a derivative of the amino acid L-carnitine, which is used to create ATP.<sup>2-4</sup>

Adenosine triphosphate, or ATP, is the primary form of utilizable energy in the cells and is sometimes referred to as the "universal energy molecule." ATP is the basic fuel of life and serves as the immediate source of energy for all the body's cells. ATP is generated through a continual metabolic process known as the Krebs cycle, also referred to as the citric acid cycle, which takes place within the mitochondria (the powerhouse or energy center) of each cell. However, in aging tissues, mitochondrial function declines, resulting in a decrease in the production of ATP and an increase in the production of free radicals as by-products of energy metabolism. Various degenerative diseases are also characterized by a decrease in the ability of mitochondria to supply cellular energy requirements. Fortunately, nutritional therapy has been used to help increase mitochondrial ATP production and enhance antioxidant status, thereby protecting mitochondria from the effects of aging. Nutritional supplements that have been reported to produce a positive effect include coenzyme Q<sub>10</sub>; antioxidants such as vitamin E and alpha-lipoic acid; vitamins, including the B-vitamins riboflavin, thiamin and niacin; as well as the amino acid L-carnitine.<sup>1,5-10</sup>

Each capsule of Cellular Energy contains:

**Vitamin E** is essential for maintaining the functions and integrity of mitochondria. An important antioxidant, vitamin E has also been shown to significantly reduce oxidative damage to mitochondria. In addition, vitamin E helps increase the body's level of superoxide dismutase (SOD), another powerful antioxidant, and plays a key role in determining tissue retention of supplemental CoQ<sub>10</sub>. Furthermore, vitamin E enhances the body's resistance to disease and appears to be important for normal functioning of the nervous system.<sup>11-15</sup>

**Vitamin B1** plays an essential role in carbohydrate metabolism (a major source of cellular energy) and is needed by every cell in the body to form ATP. Vitamin B1 also acts as a coenzyme in the conversion of glucose into energy. In addition, vitamin B1 is essential for healthy nervous system function and has been termed the "morale vitamin" as a result of its beneficial effect on mental attitude. Double-blind studies have demonstrated an association between improved vitamin B1 status and elevated mood and energy, even among participants whose B1 levels were found "adequate" according to traditional standards.<sup>11,12,18-20</sup>

**Vitamin B2** (riboflavin) functions as a necessary component for the metabolism of fats and helps convert carbohydrates into ATP. Vitamin B2 is also necessary for thyroid hormone metabolism, which influences energy production. In addition, vitamin B2 plays a role in maintaining glutathione, one of the body's most important antioxidants, and in some circumstances, acts as an antioxidant itself. Furthermore, vitamin B2 deficiency can result in enhanced oxidative stress, as well as a lack of stamina and vigor, due to mitochondrial dysfunction and disrupted energy production.<sup>11,12,16,21</sup>

**Niacin** (niacinamide), also known as vitamin B3, functions as a coenzyme to assist in the metabolism of fats and is needed for releasing energy from carbohydrates. Niacin also helps improve circulation and is essential for healthy functioning of the nervous system. Symptoms of early niacin deficiency include general fatigue and muscular weakness, as well as insomnia, irritability, recurring headaches, tension and deep depression.<sup>11,12,16</sup>

**Pantothenic acid** (vitamin B5) is involved in energy production and is essential in producing, transporting and releasing energy from fats. Pantothenic acid is also needed to make the neurotransmitter acetylcholine and to

activate the adrenal glands. Pantothenic acid participates in nerve transmissions and in the production of adrenal hormones that control the body's reactions to emotional and physical stress and the "fight-or-flight response." Pantothenic acid can also improve the body's ability to withstand stressful conditions.<sup>11,12,16,18,22</sup>

**Magnesium** plays a crucial role in numerous metabolic functions, including all reactions involving ATP, and is therefore, essential for the production and use of energy. Consequently, low levels of magnesium are equated with low levels of energy. Magnesium is also necessary for the proper transmission of nerve impulses and demonstrates a protective effect against stress-induced physiologic damage—magnesium deficiency increases the risk of stress-induced cardiovascular damage. In addition, animal studies have found that magnesium deficiency decreases specific immune responses and accelerates the progressive degeneration of the thymus.<sup>2,5,16,21,23-26</sup>

**Zinc** is an essential trace mineral that assists in the transfer of carbon dioxide—the waste product of cellular energy production—from the cells to the lungs for exhalation. Zinc also operates as a component of more than 300 enzymes that are needed to synthesize protein, promote immune system function, and protect against free radicals. In addition, zinc contributes to the proper functioning of insulin, which regulates blood sugar levels, and participates in the normal absorption and action of vitamins, especially the B-complex vitamins. Zinc also plays a critical role in the health of the adrenal glands—evidence suggests that zinc levels decline following physical and mental stress.<sup>5,11,12,16,26,27</sup>

**Manganese**, a trace mineral found in the mitochondria, is a key component of energy metabolism. Manganese is also necessary for bone and connective tissue repair, appears to help maintain bone density in post-menopausal women, and may help prevent osteoarthritis. In addition, manganese contributes to healthy nervous and immune system function, and is a component of the enzyme superoxide dismutase (SOD), a powerful antioxidant that prevents cellular damage associated with the aging process and cancer.<sup>11,12,16,26</sup>

**L-carnitine** is an amino acid that is needed for efficient fatty acid metabolism, which results in cellular energy production. L-carnitine transports fatty acids into the mitochondria where they are converted to energy. Since fatty acids are the primary fuel for energy production in the heart muscle, normal heart function depends on sufficient levels of L-carnitine. Athletes commonly take L-carnitine to improve energy levels for optimum exercise performance; however, individuals suffering from chronic fatigue may also find L-carnitine helpful for increasing energy levels.<sup>5,16,28-31</sup>

**Alpha-ketoglutaric acid** is a natural substance that functions as a component of the Krebs cycle to produce energy. Alpha-ketoglutaric acid is the precursor of glutamic acid (also known as L-glutamine), the primary amino acid contributor to brain energy stores. Research suggests that alpha-ketoglutaric acid is the most deficient substance found in cases of either physical or mental degenerative disease, initially causing symptoms of weakness. Not surprisingly, supplementation with alpha-ketoglutaric acid has been shown to provide fatigue-reducing effects. In addition, alpha-ketoglutaric acid contributes to the formation of L-carnitine, which is necessary for proper fat metabolism.<sup>5,17,32,33</sup>

**Coenzyme Q10 (CoQ10)** is a fat-soluble substance that operates as a coenzyme in the production of ATP. As an antioxidant, CoQ10 protects mitochondrial DNA from free radical (oxidative) damage and plays an important role in guarding the body against general oxidative stress. In fact, CoQ10 can actually regenerate oxidized vitamin E, thus recycling vitamin E and sustaining its antioxidant effects.<sup>2,15,34-37</sup>

**Alpha-lipoic acid** is found inside every cell in the body where it functions as an essential component of the energy-producing Krebs cycle. Alpha-lipoic acid, which can readily cross the blood-brain barrier, exhibits significant antioxidant activity, neutralizing a wide variety of free radicals. In addition, alpha-lipoic acid can regenerate other antioxidants such as vitamins C and E, thereby prolonging their free radical scavenging activity. In vitro research has also shown that alpha-lipoic acid can raise levels of coenzyme Q10 and intracellular glutathione, one of the body's most important anticarcinogens and antioxidants.<sup>38-43</sup>

**Dimethylglycine HCl**, a derivative of the amino acid glycine, is regarded as an anti-stress nutrient that also demonstrates antioxidant properties. Dimethylglycine functions as a building block for many important substances, including the amino acid methionine, choline, a variety of important hormones and neurotransmitters, and DNA. Supplemental dimethylglycine can have a wide range of beneficial effects, including helping the body maintain high energy levels and enhancing the immune system. In addition, there is some indication that dimethylglycine may help the body use oxygen more efficiently. There are no known drug, nutritional supplement, food or herb interactions.<sup>7,44-46</sup>

**Ferulic acid**, found in common foods such as barley, corn, onion and rice bran, demonstrates significant free radical scavenging abilities and has been shown to greatly reduce free radical damage in neuronal (nerve) cell systems. Researchers have suggested that ferulic acid's ability to protect against oxidative damage may prove useful in therapeutic interventions against neurodegenerative disorders in which oxidative stress is implicated, such as Alzheimer's disease. In addition, ferulic acid has been shown to dilate blood vessels, stimulate circulation, and act as a potent anti-hypertensive (a substance that reduces hypertension or high blood pressure) in animal studies. Furthermore, ferulic acid, which is also found in green tea, helps prevents nitrates in the digestive tract from being converted into carcinogenic (cancer-causing) nitrosamines.<sup>47-52</sup>

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