

## It's your time...make the most of it *with ENERGY from science & nature*

by Jerry Hickey, R.Ph., Scientific Director / InVite Health  
Edited by Lisa Flax, MS, Director of Nutrition/ InVite Health,

Despite modern technology and conveniences which are supposed to make life easier and more enjoyable, contemporary lifestyles can be very hectic and enervating. One of the most frequent grievances our clients have is lack of energy. Before addressing ways to improve energy levels, it is important to understand how energy is produced in the body. After eating, the digestion process begins by breaking food down into macronutrients (fats, protein, carbohydrates, fiber), and micronutrients (mainly vitamins, minerals and phytonutrients). Many nutrients, such as the B complex vitamins, magnesium, and amino acids, are also needed for the transformation of food into energy.



Digestion of carbohydrates, such as bread, pasta, beans, fruits and vegetables, begins in the mouth with salivary enzymes. It then continues in the gastrointestinal tract, aided by digestive juices which are released by the pancreas and present in the lining of the small intestine. For many of these foods, the final carbohydrate product is glucose, which can be absorbed into the blood. The blood carries glucose to the liver where it is stored as glycogen until it is needed to provide fuel for the body's needs. There are three pathways by

which glucose is converted into a usable form of energy called adenosine triphosphate (ATP). ATP is a high energy, phosphorus-containing molecule that is used as the ultimate source of fuel for the function of our cells. The first pathway is glycolysis, whereby the glucose is broken down into molecules of pyruvic acid and ATP. Pyruvic acid is converted into a very important substrate called Acetyl-Coenzyme A, which is then converted into ATP through a multi-step process known as the Krebs cycle. The Krebs cycle fulfills a great deal of the body's energy needs, and takes

place in the mitochondria, often referred to as the power plant of cells. The final step in the process of converting carbohydrate to energy is oxidative phosphorylation, whereby molecules that were used in the Krebs cycle generate additional amounts of ATP. The total energy gained from the complete breakdown of one molecule of glucose by all three cycles, glycolysis, the Krebs cycle and oxidative phosphorylation, is about 36 units of ATP energy.

Fats are usually ingested in the form of triglycerides, which are broken down into

free fatty acids, and eventually enter the Krebs cycle. Fats are a particularly rich source of energy for the body; Triglycerides actually yield more than twice the energy as the same quantity of carbohydrate or protein. Fatty acids, like the pyruvic acid created from glucose, also are used in the creation of Acetyl-Coenzyme A.

When protein is digested, it is broken down into individual amino acids, many of which are also used in the Krebs cycle. For instance, the amino acid L-carnitine is involved with this function, which explains why supplementation is so important and useful for restoring energy. L-carnitine actually shuttles the Acetyl-Coenzyme A into the mitochondrial tissue where it is used to create ATP energy.

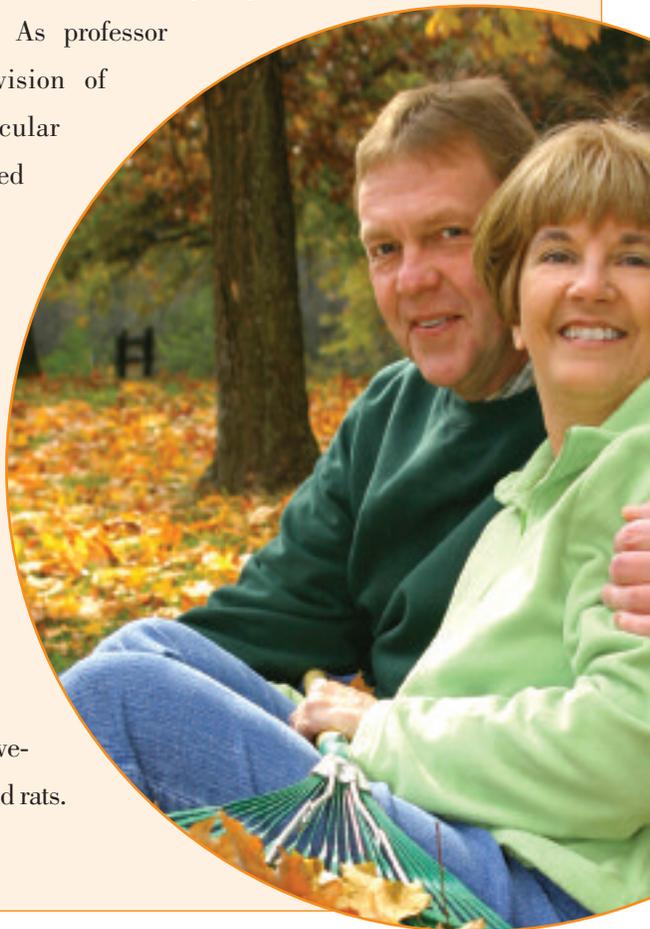
In addition to its role in the Krebb's cycle, L-carnitine also removes accumulated fatty acids from the cells before they become toxic, keeping these power plants healthy and functioning at a peak level. L-carnitine is well utilized by muscle, heart, liver, kidneys and most of the cells of the body, but does not readily enter the brain. The acetylated form of L-carnitine, known as acetyl-L-carnitine (ALC), can cross through the protective barrier at the base of the spine and enter into the brain, where it is used for mental energy. This form has the added benefit of supplying acetyl groups to aid in the creation of Acetyl-Coenzyme A. The acetyl group is also used to create the neurotransmitter acetylcholine in the brain, necessary for both memory and learning.

Several studies have revealed numerous benefits attributed to both forms of L-carnitine. In a group of 120 aging men, it was found that ALC improved heart function, decreased depression and improved energy and endurance. It also improved male sexual function and the ability to have an erection, and it did so better than testosterone. In a group of patients with chronic fatigue syndrome, ALC significantly reduced mental fatigue and improved attention-concentration. In a group of elderly men, supplementa-

**A**lpha-Lipoic Acid (ALA) is a powerful antioxidant. Most reactions involving ALA take place in the mitochondria, where it reacts with pyruvate in the Krebs cycle. ALA scavenges a wide range of reactive oxygen species (ROS), which would otherwise cause free radical damage to the mitochondria. This free radical damage to the mitochondria is actually a cause of aging, rather than a consequence. Because ALA can neutralize a wide array of free radicals it helps retard or possibly reverse the aging process in the mitochondria, resulting in better energy production. ALA also restores antioxidant activity in vitamins E and C, co Q-10, and glutathione. In middle aged and elderly rats with increased levels of free radicals and decreased antioxidant levels, a combination of L-carnitine and ALA was more effective at reversing these age related trends than giving either supplement alone. As professor Bruce Ames from the Division of Biochemistry and Molecular Biology at UC Berkeley stated whimsically, but accurately, that giving elderly rats a combination of ALC and ALA causes their brain to dance the Macarena; the combination is that good at reversing aging and restoring energy production. In one study, this combination improved the ability to move in both old and young rats, but the improvement was much greater in the old rats.

tion with L-Carnitine resulted in increased lean muscle mass, and a decrease in body fat, LDL cholesterol, and triglycerides. L-carnitine decreased physical fatigue by 40% and mental fatigue by 45% compared to placebo. Another study found that L-carnitine not only helped lower triglycerides, but also improved levels of protective HDL cholesterol. ALC may help treat Alzheimer's

disease and other dementia disorders, as well as age-related deficits in the brain. Fatigue is very common in multiple sclerosis (MS) patients treated with drugs, which may be related to the fact that drug treatments for MS are associated with decreased levels of L-carnitine. A recent study found that giving L-carnitine to drug-treated MS patients decreased the intensity of fatigue



in 63% of them. In a study of 100 obese people, when L-carnitine was added to a moderate exercise and diet program, there was a 25% greater loss in body weight and an improved body mass index. LDL-cholesterol, blood sugar, and blood pressure were also significantly lower in the L-carnitine group. In a study of patients with advanced cancer who were receiving traditional treatment, supplementation with L-carnitine significantly decreased fatigue and improved quality of

life. The L-carnitine supplementation also improved lean body mass and appetite to a significant degree. Other drugs that may cause a deficiency in L-carnitine include valproic acid (an anticonvulsant) and some HIV medications (AZT, ddI, ddC, d4T).

There is some evidence that L-carnitine may prevent the damage caused to the heart by the

chemotherapeutic drug Doxorubicin (Adriamycin). The chemotherapeutic drugs Ifex and Cisplatin (also known as Platinol) can also cause a deficiency of L-carnitine. When patients

taking these medications were given L-carnitine, the chemotherapy-induced fatigue was reduced.

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**“Rhodiola rosea decreases both mental and physical fatigue, improves energy levels, elevates mood, and increases resistance to stress, infection, and pollution. It may even help with high blood pressure and depression.”**

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**Coenzyme Q-10 (co Q-10)** is found in almost every cell of our body. It is used to transport electrons in the mitochondria during the Krebs cycle, and is needed to derive energy from glucose and fatty acids. Not only do co Q-10 levels decline gradually with age, but they also decline in diabetics, cancer patients, and in

patients with heart failure. Levels are also depressed in ischemic heart disease and in patients with angina, cardiomyopathy, mitral valve stenosis, aortic valve stenosis, septal defects, arrhythmias, and high blood pressure.

Reactive oxygen species are a byproduct of energy production in the mitochondria, and are the cause of free radical damage (for which antioxidants are the antidote). The oxidative damage they cause accumulates in the mitochondria, causing them to function less efficiently over time. Co Q-10 rejuvenates mitochondria, thus improving their function, and also acts as a protective antioxidant. One of the hallmarks of the aging process is a decreased ability to create energy in many tissues, especially the heart, skeletal muscle, and the liver. Age-associated decreases in co Q-10 have been proposed as playing a key role in this energy decline. In patients with stable heart failure and ischemia, supplementation with co Q-10 improved their exercise stamina and blood flow. Untrained men in their mid forties were supplemented with either co Q-10 or a placebo for two months. Self-reported vigor was significantly increased in the supplemented men compared to the placebo, and lactic acid production was decreased. Accumulation of lactic acid in muscle causes a burning sensation. Lactic acid buildup can eventually cause



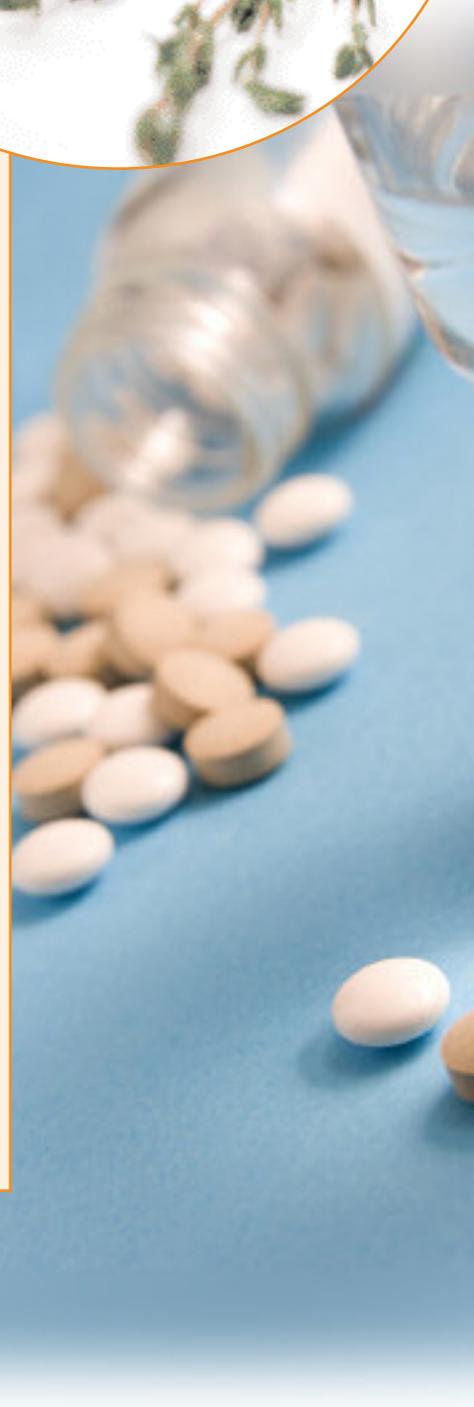
**N**ucleotides and nucleosides are the components of DNA and RNA, and under certain conditions it becomes essential to supplement with them in order to meet the body's physiological requirements. These conditions can include poor immune function, injury, surgery, illness, or broken bones. Ideally, it is advisable to start supplementing before surgery in order to reduce complications and the risk of infection. Nucleotides are also beneficial during periods of growth, dieting, during intense physical training, in certain disease

states, and during exposure to conditions that cause fatigue or poor immune function. A body of research came out of NASA recently, which dealt with prevention of occupational hazards common to astronauts. Astronauts are routinely confined to small spaces and exposed to intense radiation and zero gravity, conditions which lead to loss of muscle mass and a weakened immune system. Research has also demonstrated benefits for premature infants, athletes, and exercisers, as well as people recovering from injury, surgery, and ulcers.

the muscle to cease functioning, thereby preventing one's ability to use the muscle to the point of maximal exhaustion. Twenty eight male cyclists were given either co Q-10 or placebo. It took longer to reach muscle fatigue in the supplemented group.

**R***hodiola rosea* is an herb that grows in the arctic regions of Siberia. Traditionally, rhodiola rosea has been prepared as a tea to boost energy in Asia and Eastern Europe for centuries, and modern science strongly supports this use. Rhodiola rosea decreases both mental and physical fatigue, improves energy levels, elevates mood, and increases resistance to stress, infection, and pollution. It may even help with high blood pressure and depression. Rhodiola rosea is also known to enhance work performance and exert protective effects in the pancreas and liver. Furthermore, it is beneficial for the lungs, heart and circulatory system. The manner in which rhodiola rosea improves energy, endurance, and fatigue is by enhancing the creation and restoration of ATP for quicker recovery from exercise, improved mitochondrial function, accelerated rate of physical recovery, and greater physical work capacity. In one study, rhodiola rosea improved the capacity to perform endurance exercise in young healthy volunteers who consumed larger, "loading" doses. In a placebo-controlled, crossover trial, a group of 56 young, healthy physicians on night

duty received rhodiola rosea supplementation for a two week period. At the conclusion of the study, not only was mental fatigue reduced, but there was improvement in memory, calculation and concentration ability, and speed of audio-visual perception. A group of 161 cadets aged 19 to 21, who are under intense physical and mental stress, were given either a placebo or rhodiola rosea. The rhodiola demonstrated a pronounced anti-fatigue effect. In a study of 104 patients who were either slated for lung surgery or suffering from massive trauma or infection in the lungs, rhodiola rosea was ingested for 3 to 15 days preceding surgery and for 5 to 7 days following surgery. Rhodiola rosea supplementation was associated with reduced acute lung injury caused by surgery and reduced complication rate of Acute Respiratory Distress Syndrome (ARDS) by about 50%. ARDS is a pulmonary malfunction caused by damage to the air sacs and small blood vessels in the lung. Blood and other fluids rush into the air sacs making it difficult to breathe. The condition is potentially fatal due to respiratory failure caused by lack of oxygen.



As a professional who counsels a broad spectrum of people suffering with, or recovering from, various conditions, I can tell you from my heart that the correct combination of supplements can be truly beneficial in restoring or improving both mental and physical energy. – Jerry Hickey, R.Ph.