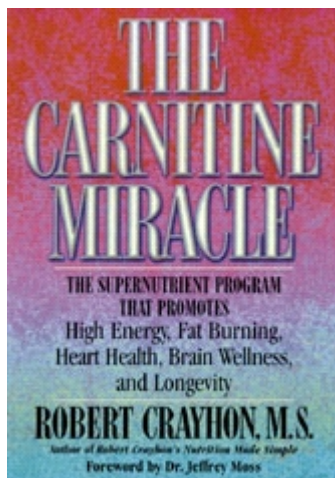


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REPORT

**Energy, Health and Mental Agility**

The Carnitine Miracle: The Supernutrient Program that Promotes High Energy, Fat Burning, Heart Health, Brain Wellness, and Longevity by Robert Crayhon

Book review by Ivy Greenwell

The most valuable thing you can give your cells is energy," according to Robert Crayhon, a nutritionist who devoted years of study and clinical practice to the use of carnitine and its better absorbed and more active form, acetyl-L-carnitine. "It is the single most remarkable nutrient I have used in my nutrition practice over the past twelve years," Crayhon states.

Gradual decline in the ability to produce energy in the mitochondria is one of the hallmarks of aging. It is a vicious circle: low energy production leads to overall dysfunction and thus plays a significant part in many aging-related disorders; aging itself leads to lower and lower energy

production. It is hard to say which comes first. Do we have less energy because we have aged, or have we aged because we produce less energy? The only answer seems to be "both." We also know that higher energy output correlates highly with health and younger physiological age.

Symptoms of carnitine deficiency include low ability to exercise, with rapid onset of fatigue, weakness and muscle pain. How sad that in the elderly this is disregarded, since "general weakness" and low energy are considered to be part of "normal aging."

"You are only as young as your mitochondria," Crayhon claims. He does have a point. As we age, our mitochondria produce less and less energy (in the form of chemical energy, or ATP). This energy becomes directed toward survival processes such as ion transport, rather than cell repair and tissue building. Consequently, tissue deterioration sets in. As we will see later, however, mitochondrial function can be rejuvenated with acetyl-L-carnitine.

Carnitine is not an amino acid

Strictly speaking, carnitine is not an amino acid, Crayhon points out. That was an erroneous early classification that seems to have stuck for good. In fact, carnitine does not contain the amino group (NH₂). Rather, carnitine is a coenzyme, a water-soluble vitamin-like compound. It is similar to choline, one of the B vitamins-and, like various B vitamins, carnitine helps us turn food into energy. More specifically, it is essential for the burning of long-chain fatty acids.

Few people seem to realize that fatty acids are the primary fuel for the muscles, including the heart-up to 70% of energy produced by the muscles comes from the burning of fats. Carnitine is essential for the transport of long-chain fatty acids; short- and medium-chain fats are able to pass through the mitochondrial membrane without needing a transporter.

Humans can synthesize a small amount of carnitine from the amino acid lysine. Given sufficient lysine and cofactors, we can synthesize some portion (perhaps 25%) of the carnitine we need for optimal energy production. The rest has to come from diet and supplements. Meat, fish, milk, eggs, cheese and other animal products in general contain preformed carnitine. Mutton and lamb are particularly rich sources, followed by beef. Human milk also contains relatively high levels of carnitine, since newborns are at first incapable of producing it. Eggs are a poor source of carnitine. Plant food contains at best only negligible amounts of carnitine, with the exception of somewhat higher levels in avocados and tempeh.

Crayhon points out that due to high consumption of red meat, the Stone Age hunter probably got at least 500 mg of carnitine a day, and possibly as much as 2 grams. Today the average carnitine intake is estimated at a mere 30 to 50 mg a day. Strict vegetarians consume practically no carnitine. Since their diet may also be poor in lysine and methionine, vegetarians are likely to be especially deficient in carnitine. Consequently carnitine levels are low in vegetarians consuming chiefly a grain-based diet. And hardly anyone gets the 250 to 500 mg of carnitine per day that is regarded as optimal (with more needed under stress and other special circumstances). In order to get 500 mg, we would have to consume over two pounds of beef every day.

Carnitine may slow aging

"Energy is the greatest anti-aging force there is. The more energy your cells have, the slower they age," Crayhon states. The older a person gets, the more the aging process accelerates. Why? According to Crayhon, the main cause of the accelerating degenerative spiral is the ever-increasing energy insufficiency at the cellular level. As we age, our energy-producing system deteriorates. What follows is the vicious circle of energy insufficiency leading to various diseases, and disease leading to even less energy production and thus ever more degeneration. Less energy means poorer physiological function and a "slowing down," whether we look at physical or mental performance. The elderly are the very picture of this "energy crisis" of aging.

Why are the anti-aging effects of carnitine so profound and manifold? Crayhon's answer is simple. "If you give your cells the ability to make optimal levels of energy, they can use it to do whatever they want: build and renew cell membranes, create and maintain cell structures, and replicate and protect cell information." Our immune function depends on adequate energy production, as does tissue maintenance such as bone building and muscle building. In fact it's impossible to think of any physiological function that is not linked in some way to our energy supply.

"The most important healing element in your body is energy," Crayhon believes. Cells supplied with abundant energy are free of disease. Thus, the first step toward greater health and rejuvenation should be energizing your cells so they can better perform their various functions, as well as protect themselves against free radicals and various pathogens. The field of bioenergetics has emerged as extraordinarily important for our understanding of the aging process. Consequently, Crayhon regards carnitine and acetyl-L-carnitine as premier anti-aging nutrients.

We need much more carnitine as we grow older, Crayhon repeatedly points out. One reason is that as circulation declines with age, so does oxygen supply to the cells. Part of the "carnitine miracle" is that it allows cells to function well even under conditions of decreased oxygen.

Another part is that carnitine enhances the immune function. As we have already mentioned, cells that have more ATP (that is, more energy) can better defend themselves against bacteria and viruses. Carnitine also increases the number of immune cells. In addition, it helps prevent muscle loss during serious illness, thus protecting the body's pool of amino acids, essential for the synthesis of various immune substances. Carnitine also enhances liver function, which clearly benefits the entire body.

Weight loss

"Weight loss is not merely a matter of calories, but of metabolism" is Crayhon's credo. Carnitine and omega-3 fatty acids increase energy production; this, together with some degree of carbohydrate restriction, ensures successful weight loss. Crayhon cites both case studies and scientific research to support this point.

Crayhon considers carnitine the most important supplement for enhancing weight loss. Like older people, the obese also have lower levels of carnitine. And without sufficient carnitine, they have more difficulty burning not only their body fat, but also their glucose, since it turns out that thanks to increasing the fluidity of the mitochondrial membranes, carnitine also enhances the production of energy from glucose.

The elderly and the obese are joined by those who are hypothyroid as yet another category of people with low carnitine levels. It is no surprise that low energy, circulation problems and a poor serum lipid profile are typical for these groups. The same is true of Type II diabetics. While Crayhon favors carnitine and acetyl-L-carnitine supplements for everyone over 40, he specifies that people who are elderly, obese, hypothyroid or diabetic have a particularly urgent need.

For weight loss and weight maintenance, carnitine supplements should be combined with a diet that is relatively low in carbohydrates (no more than 50% carbohydrates). These carbohydrates should be what Crayhon calls "paleocarbs"-the low-glycemic, fiber-rich plants (nuts, seeds, vegetables, tubers and small, tart wild fruits) that were available to our ancestors.

It is also desirable to combine carnitine with omega-3 fatty acids, such as those found in fish oil and flax or perilla oil. Omega-3 fats enhance the activity of carnitine, and thus contribute to better utilization of fat for energy (a process technically known as "beta oxidation"). There is some evidence that DHA, a fatty acid found in fish oil, is particularly important. Our bodies may not be very efficient in producing DHA, and thus it is highly desirable to consume cold-water fish and/or take fish oil supplements. Crayhon is also a fan of MTC's, or medium-chain triglycerides, found in coconut oil (if you prefer pure MTC oil and don't mind its price, it is also available).

Crayhon warns against combining high levels of fats and high levels of carbohydrates. That is the recipe for obesity, since this is the condition under which dietary fat will be quickly turned into body fat. But otherwise fat is not automatically fattening: if fat is eaten with only small amounts of carbohydrates, it will be used for energy. According to Crayhon, high levels of dietary fat do not automatically lead to disease. The latter occurs only if the fat is combined with excess carbohydrates. This combination became

possible only with the advent of agriculture, and was not an option in Paleolithic times. Our bodies have not evolved to handle it. Thus, if high amounts of fat are consumed, then carbohydrates have to be restricted, and vice versa. Again, Crayhon's basic recommendation is that carbohydrates should not exceed 50% of our calorie intake.

What about protein? How much protein do we really need? Crayhon is unwilling to commit himself to any specific number of grams per day. His reasoning is that we need to establish an optimum range, not a minimum required for mere survival. His advice is that each individual should experiment to see what amount of protein makes him/her feel and function best. Among the benefits of protein, he points out the little-known finding that protein raises HDL cholesterol, which might partly explain why diets higher in protein have recently been found to lower the risk of cardiovascular disease. Excess carbohydrates, on the other hand, lower HDLs and raise triglycerides.

Protein also helps curb appetite. It stimulates the vagus nerve more strongly than carbohydrates, signaling satiety. It is very easy to overeat starches and sugars; protein consumption, by contrast, results in a strong "stop eating" signal that naturally regulates our intake.

Since meat is a rich source of carnitine, it is not surprising that Crayhon is no vegetarian. He does point out, however, that today's beef is not the kind of healthy food it used to be before the introduction of processed grain feed. Meat from game or from pasture-fed cows provides more of the precious omega-3 fatty acids and CLA. For that matter, many nutritionists point out that farm-raised fish and shrimp are also fed not their natural omega-3-rich food, but a commercial feed that provides mainly omega-6 fatty acids. Again, the balance of fatty acids in seafood protein is being distorted.

Crayhon is not worried about saturated fat. It is the excess omega-6 fats hidden in meat that he warns about. Excess omega-6 fats have been linked to increased inflammation, and hence to heart disease and cancer. Since the cattle industry is unlikely to change its practices unless there is sufficient pressure, Crayhon urges readers to write meat manufacturers, requesting they include flaxmeal in the feed. This simple, inexpensive addition could make a significant difference in the lipid profile of beef. "Meats of all kinds can be wonderful for us if the animals are raised and fed correctly. It can be the best food in our diet," Crayhon states. But the return to true Paleolithic diet of game meat and uncultivated fruits and vegetables is not possible. At this point, about the only way we can correct the omega-3 scarcity is either to eat a lot of wild-caught fish, or to take fish and flax oil supplements.

Crayhon favors the "eat fat to lose fat" approach. But of course it takes the right fats, the kind that enhance aerobic metabolism. Omega-3 fatty acids have even been dubbed "anti-obesity fats," since they appear to increase the metabolic rate (CLA could also be regarded as an "anti-obesity fat"). They lower triglycerides, thus lowering the risk of cardiovascular disease. They also change the balance of fatty acids in cell membranes, favoring the production of anti-inflammatory prostaglandins-possibly a major factor in the prevention of cancer, heart disease and Alzheimer's disease. More recently, the antidepressant effect of omega-3 fatty acids has also gained attention. And omega-3 fats make saturated fat safer by preventing it from inducing insulin resistance. Some saturated fat, in turn, may help in the utilization of essential fatty acids.

Apart from the warning against trans-fatty acids and commercial vegetable oils, Crayhon tries not to demonize any particular kind of fat. Rather, he advises the reader to strive for balance between the various kinds of fats. He suggests that the ratio of omega-6 to omega-3 fatty acids should probably be 1:1, rather than the conservative mainstream recommendation of 4:1-still vastly superior to the 16:1 ratio estimated for the American diet. This imbalance, reflecting an extreme deficiency of omega-3 fatty acids, is likely to be one of the major causes of the epidemic of obesity that we are witnessing in the wake of aggressive anti-fat campaign.

Crayhon points out that "the improvements in triglycerides and HDL cholesterol have been most favorable when the diet contains no more than 40 percent carbohydrates," but he is not opposed to any diet that does not exceed 50% of calories from carbohydrates. He says he puts most of weight-loss clients on a 30% carbohydrate diet; for the majority of them, the percentage goes up to about 45% for maintenance.

Crayhon's major virtues are flexibility and common sense. We can consume as many antioxidant-rich vegetables as a typical vegetarian, Crayhon points out, and still enjoy the robust sense of energy, vitality and good cheer that seem linked to the consumption of quality animal protein and healthy fats, i.e. omega-3's, olive oil, short- and medium-chain triglycerides.

Crayhon is also one of the few diet gurus who understands the importance of pleasure for weight loss. Paradoxical as it may sound, savoring the food helps us feel satisfied sooner and eat less. "Enjoy your meals," Crayhon advises. "If you don't, you will develop a pleasure deficiency. Pleasure is the most important nutrient of all, for it feeds the soul. A pleasure deficiency will push you off your diet faster than anything else." Pleasure in general is the most neglected anti-aging factor, rarely mentioned in anti-aging books, even though we all know how crucial it is for optimal health. It is brave and honest of Crayhon to say, "Pleasure is the most important nutrient of all."

Mitochondrial function

Our understanding of the importance of carnitine and acetyl-L-carnitine has taken a huge leap forward thanks to the groundbreaking

research of Bruce Ames and Tom Hagen. Considering that mitochondria are seen as the "Achilles' heel" of our physiology, the most vulnerable part of the cell and arguably the place where the aging process truly begins, anything that can reverse age-related mitochondrial dysfunction should have enormous implications.

Carnitine has been likened to a fuel pump or a forklift. It functions primarily as a transporter. It picks up free fatty acids from the plasma and delivers them across the mitochondrial membrane, so they can be utilized for energy production. Carnitine also transports waste products out of the mitochondria, thus ensuring that toxic metabolic waste products do not accumulate. This has been referred to as "the carnitine shuttle." Thus, the amount of available carnitine is a key factor in energy production, particularly in terms of the body's ability to "burn" long-chain fatty acids.

Just as many old people can barely walk across the room without feeling so tired that they have to sit down and rest, so old animals too move less and less. Old laboratory rats move around much less than young rats—only about one-third as much. But when Bruce Ames supplemented the diet of 24-month-old rats—the equivalent of 85-year-old humans—with acetyl-L-carnitine, in less than one month they began to be significantly more active. It was as if 85-year-old men started moving about as briskly as 40-year-olds. Moreover, the acetyl-L-carnitine-supplemented old rats also showed remarkably improved cognitive function, learning mazes practically as quickly as young rats. Increased production of acetylcholine may be the main factor here.

More recent studies discovered that acetyl-L-carnitine does indeed considerably increase the mitochondrial energy output, especially when combined with lipoic acid. Together, acetyl-L-carnitine and lipoic acid have been found to rejuvenate mitochondrial function almost to youthful levels. The word from the Berkeley lab was "a startling rejuvenation." And thus acetyl-L-carnitine emerged as one of the superstars of alternative anti-aging medicine.

Lipoic acid is not only an energizing nutrient, but also a crucial antioxidant. In fact, now we know that acetyl-L-carnitine should be combined with antioxidants to compensate for the increased production of free radicals that is a byproduct of greater energy output. When lipoic acid is used together with acetyl-L-carnitine, the level of oxidants is reduced to that seen in young rats. It would be interesting to see if the addition of CoQ10 would improve these results even further.

Carnitine was discovered in 1905, but its tremendous importance began to be understood only in the 1970s. And it is only now that we are beginning to grasp the potential of acetyl-L-carnitine supplementation for rejuvenating mitochondrial function, and thus for reversing the symptoms of aging. Crayhon is right: we are only as young as our mitochondria.

Brain protection

One of the current mainstream beliefs is that if we live long enough, we are practically sure to develop Alzheimer's, Parkinson's or another dreadful neurodegenerative disease. Crayhon believes that this tragic kind of decline and slow dying is largely preventable. Although we now know a multitude of brain-protective compounds, the crucial supplement may be acetyl-L-carnitine.

Around the age of 40, our production of acetyl-L-carnitine begins to decline. This parallels the simultaneous acceleration of aging as shown by the decline in the production of CoQ10, glutathione, acetylcholine and melatonin. In women, this also marks the time when bone density takes a downward turn, the risk of breast cancer suddenly rises, and countdown toward menopause begins in earnest. Maybe we should be investigating what happens in the late thirties in more detail from the perspective of anti-aging medicine.

The late thirties are also typically the time of life during which many people notice that even though they are watching their diet and exercising more than before, they are gaining weight as never before. They also seem to get tired more easily. "Youthful energy" is gone. Which comes first: the mid-life decline in energy production, or the accelerated aging and weight gain that we see starting around the age of 40? We are back to the vicious circle that is part of any consideration of energy output, physiological performance, and aging. The more important question is whether anything can be done about this decline.

While exercise increases the conversion of carnitine into the more potent acetyl-L-carnitine, after the age of 40 the combination of carnitine and regular exercise is not enough. Acetyl-L-carnitine is clearly the preferable anti-aging supplement. Only acetyl-L-carnitine can increase the energy of brain cells. The neuroprotective benefits alone would be enough to place acetyl-L-carnitine among the top five anti-aging superstar supplements.

Besides enhancing fatty acid transport and utilization, acetyl-L-carnitine also increases the density of neurotransmitter receptors, the levels of neurotransmitters such as acetylcholine and dopamine. In addition, it reduces the accumulation of lipofuscin (a metabolic waste product related to lipid peroxidation, seen at particularly high levels in dementia), counteracts glycation (thus possibly protecting against cataracts), and promotes melatonin production. (Crayhon mentions one side effect of acetyl-L-carnitine: vivid dreams. This may be due to increased melatonin.)

Acetyl-L-carnitine also restores cortisol receptors, and boosts the levels of glutathione and CoQ10. Functioning as an antioxidant, acetyl-L-carnitine scavenges the dangerous superoxide radical. It also counteracts ammonia toxicity. Supplementation with acetyl-

l-carnitine has been shown to reduce degenerative processes in the nervous system, and improve memory and learning ability. All in all, acetyl-l-carnitine qualifies as the superstar of neuroprotection. And since the brain is our most important organ, it could be argued that acetyl-l-carnitine is therefore the most important anti-aging supplement.

On a daily basis, acetyl-l-carnitine protects neurons against the ravages of stress. Stress is one of the primary causes of brain aging, and Crayhon-"you are as young as your brain"- is sufficiently broad-minded to acknowledge that too. Acetyl-l-carnitine "tunes up" the nerve tissue so that it can better cope with stress. A low-carnitine, de-energized person with low neurotransmitter levels is typically irritable and can't stay calm under pressure. But Crayhon is not saying that all we need to do is take acetyl-l-carnitine and simply go on living in the fast lane. His common-sense advice is to take frequent breaks during work, drink a cup of chamomile, help yourself to valerian and/or kava as needed, take a bath in Epsom salt to relax and provide much-needed magnesium. Acetyl-l-carnitine is only part of the solution.

One interesting application of acetyl-l-carnitine is as adjuvant treatment in Parkinson's disease. It is by no means a cure. Acetyl-l-carnitine can at best slow down the progression of this terrible disorder, especially when used together with another important energizing coenzyme, NADH, as well as several other energizers and neuroprotectants, under the supervision of an experienced clinician. Acetyl-l-carnitine does appear to induce more dopamine release, and also helps the neurons respond to dopamine. Alzheimer's disease and amyotrophic lateral sclerosis (ALS, also known as Lou Gehrig's disease) also respond to higher doses of acetyl-l-carnitine combined with other neuroprotective supplements. Recovery after stroke is another area where acetyl-l-carnitine supplementation can make a difference.

Crayhon also mentions something of great interest to women. PMS typically worsens as a woman approaches menopause. Based on research and his own clinical experience, Crayhon suggests that 2 grams of acetyl-l-carnitine is an effective dose for treating PMS.

Acetyl-l-carnitine apparently works to improve hormonal balance, probably by promoting the health of the hypothalamus and the pituitary gland, Crayhon theorizes. There is, however, a more immediate explanation. Acetyl-l-carnitine changes the balance of fatty acids in cell membranes, resulting in a decreased arachidonic acid cascade, and leading to lower levels of inflammatory prostaglandins. PMS and cramps, backache, diarrhea and other menstrual misery are primarily inflammatory events. That is why high doses of omega-3 fatty acids are so helpful, as are good standard anti-inflammatories such as ibuprofen, and the new selective NSAIDs, Celebrex and Vioxx. Given the greater safety of omega-3 fats and carnitine, and their overall health benefits, they should be the first choice.

Cardiovascular health

The heart and the brain are especially rich in mitochondria, and hence also especially vulnerable to mitochondrial damage and the resulting decrease in energy output. Both the heart and the brain need an enormous amount of energy. This is especially obvious when we consider the extraordinary non-stop work of the heart.

Since the heart is our hardest-working muscle, it is no surprise that carnitine improves myocardial metabolism. The latter is evidenced by increased fatty-acid uptake by the mitochondria, and higher concentrations of ATP and creatine phosphate (a storage form of ATP) in the heart tissue after carnitine supplementation. Fatty acids are a particularly important source of "fuel" for the heart. Carnitine makes the heart work more efficiently, reducing heart rate during intense exercise. Crayhon stresses that especially older adults who take up exercise greatly benefit from carnitine supplementation (combined with antioxidants, of course).

There is also the well-documented finding that carnitine lowers triglycerides, and this alone dramatically lowers the risk of heart disease. Crayhon recommends that triglyceride levels should be kept below 100-a radical proposition in view of the official creed that anything up to 150 is "safe." But Crayhon is right: the risk of heart disease doubles when triglycerides go over 100. Thus, if we really desire clean arteries and optimal cardiovascular health, we should restrict carbohydrates (including fructose), use omega-3 fats and carnitine, exercise, and do whatever else it takes (Crayhon specifies his triglyceride-lowering regimen in a special section) to keep our triglycerides around 75 or so. A combination of carnitine (and/or acetyl-l-carnitine), CoQ10, lipoic acid, vitamin E and omega-3 fats, in the context of a low-glycemic, vegetable-rich, insulin-lowering diet, is certainly going to be beneficial for the cardiovascular system.

Lower plasma triglycerides means that blood is less thick with fats, and can move more easily even through the narrow capillaries. And since carnitine also raises HDL cholesterol, blood vessels stay cleaner, again improving blood flow. Thus, blood pressure may also go down to healthier levels thanks to carnitine supplements (although Crayhon is quick to add that the best nutrient for treating hypertension is taurine). While carnitine makes cells perform better even when circulation is poor, carnitine in fact improves circulation. It also helps prevent cardiac arrhythmias. In addition, carnitine improves insulin sensitivity and promotes optimal carbohydrate metabolism. In diabetics, it also lowers the levels of glycosylated hemoglobin. While carnitine supplementation is particularly critical for diabetics, no cardiovascular protocol is complete unless it includes carnitine and/or acetyl-l-carnitine.

Concluding highlights

The great virtue of Crayhon's book is that it does not promote carnitine or acetyl-L-carnitine as the answer to aging, or all you need to take to lose weight, be happy, prevent heart disease and Alzheimer's disease, and so forth. Wisely, Crayhon sees carnitine as only one crucial player in the complex process of cellular energy production. He advocates the use of carnitine and acetyl-L-carnitine supplements in the context of an insulin-lowering diet that is low in refined carbohydrates, and together with other supplements that enhance aerobic metabolism: the omega-3 fatty acids, CoQ10, lipoic acid, and various antioxidants.

Crayhon's book is meant as an introduction to the benefits of carnitine and acetyl-L-carnitine. Though it lists almost 200 references, it is written at a popular level, with case histories and question-and-answer sections. It is meant for the less technically minded reader, for whom learning that carnitine transports free fatty acids to the mitochondria, and enhances the use of fat for energy is sufficient.

But even advanced readers can learn something from Crayhon's emphasis on the bioenergetics of health and aging, and from his holistic presentation of carnitine in the context of other energy nutrients, and of diet in general. In this age of chronic fatigue, it is invigorating just to read a well-written book on the subject of enhancing energy-with the urgent message that energizing our cells is of primary importance in slowing down aging

Another virtue of the book is that Crayhon is the opposite of a namby-pamby, waffling, conservative nutritionist who typically recommends insufficient supplements in insufficient doses. Crayhon's commitment to optimal health and anti-aging is unquestionable, and he does not mince words. If you are over 40, Crayhon says, it is mandatory that you take acetyl-L-carnitine. Advanced life extensionists have been taking it for years; it is time to make its benefits known to the broader public.

Crayhon is wise enough to realize that carnitine and acetyl-L-carnitine should not be taken by themselves, as a miracle pill that will cure obesity by turning excess body fat into energy. Rather, he insists that we take these marvelous compounds together with other energy cofactors such as CoQ10, as well as with omega-3 fatty acids and various antioxidants-and that we eat an energy-enhancing diet. Thus, it is not a matter of arguing which supplement is the most important: is it carnitine, fish oil or lipoic acid? They are all important, and they all work together, Crayhon would reply. By all means take fish oil and lipoic acid (and more) together with carnitine. Everything about aging is multifactorial, and the preventive approach must be multifactorial also. Crayhon is to be applauded for his remarkably holistic, "network" approach, one that includes diet, exercise, supplements and psychological health.

Precautions and recommendations

Increased energy production means a greater generation of free radicals, so carnitine and acetyl-L-carnitine should be taken together with antioxidants. Older people especially need to take extra antioxidants to compensate for this. Therefore, consider taking more alpha-lipoic acid, CoQ10, vitamin E and other antioxidants along with carnitine and acetyl-L-carnitine. Important notice: Carnitine and acetyl-L-carnitine supplements are not recommended for individuals suffering from epilepsy or manic-depression unless used under medical supervision.

Dosage and Timing

The most common mistake, Crayhon warns, is taking a suboptimal dose such as 250 mg. Trying to save money by taking an ineffective low dose ends up being a waste of money. People differ in their need for carnitine supplements: some may notice an energizing effect already with 1 g of carnitine or 500 mg of acetyl-L-carnitine, while for others it may take as much as 4 g of carnitine or 1.5 g of acetyl-L-carnitine. Crayhon advises starting at the low end and increasing the dose until you feel the difference.

For weight loss, you can start at 500 mg of carnitine and work up to 2 g/day. Crayhon states that it may take up to 4 g/day for some seriously overweight individuals. You have to experiment.

Because of their invigorating effect, carnitine and acetyl-L-carnitine should best be taken in the morning rather than evening, or at least not too late after lunch. Crayhon repeatedly warns that taking carnitine and/or acetyl-L-carnitine too late in the day could cause difficulty falling asleep, and sets 3 p.m. as a limit. To maximize benefits, Crayhon also suggests taking both carnitine and acetyl-L-carnitine.

At what age should one start taking carnitine supplements? As early in adulthood as possible, Crayhon replies. College students, for instance, are often under terrific stress, Crayhon points out, and such stress does damage nerve cells, even though the damage may not yet be detectable. Thus, college students would do well to do all they can to protect their brain cells. Crayhon's position is that prevention should start early in adult life. Do not wait until deterioration becomes obvious; it is easier to prevent damage than to reverse it. Some may see this as a radical approach, but we hope that most readers see it simply as common sense. Crayhon's philosophy of anti-aging is the opposite of the "too little, too late" syndrome that we witness quite often even in

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