

Vitamins, Supplements & Their Uses

I. Introduction

Our interest in vitamins, dietary supplements, and nutritional biochemistry began in 1994. I in particular was a severe skeptic about supplements in general, and thought everything one's body needed could be supplied from a "healthy diet". This, of course, is true to some degree. Healthy diets allow one to live a long and pleasant life. This does not mean, however, that such a diet provides optimum nutrition. It was only through the persistent pestering of my wife, Rosalinda, that I finally agreed to try one supplement: Chromium Picolinate. That was such an obvious success in providing increased energy and a feeling of well-being that I began to read extensively on the subject of nutritional biochemistry.

If you become interested in this field, one recommendation that is of the greatest importance is to read, and to be very selective about your reading. There is a plethora of pseudo-scientific literature out there under the topics of health and nutrition. This is one of the reasons the items listed below concentrate on non-herbal medicine. It is simply because there are more "western" scientific studies dealing with vitamins and amino acids, etc., that have "hard science" behind them. This is not to say that herbal medicine is without merit. It is simply to say that it is currently harder to find secure scientific facts about such topics. Let's hope this changes in the future.

The information given below is a distillation of some of the information I have found in over thirty books, a multitude of scientific papers, and the internet (especially medline). It was put together because a lot of people began asking me questions about dietary supplements and asked me to write down a brief summary with some recent references (most of these facts could be supported with a list of references that runs into the tens or more). The information is not exhaustive, and I am not a trained biochemist working in this field. It is, however, very interesting, and I think it is beginning to tell a story about the extreme importance of "mega"-nutrition to health and athletic performance (I can certainly provide my own anecdotal evidence for this). To provide information beyond what is presented below, I've included a suggested reading list which contains a selection of books which I consider to be the best examples of approachable, popular scientific literature on the subject. These books are not afraid of providing lots of facts backed up by sometimes hundreds of references to the original scientific literature. I highly recommend them. They will help lead you through some of the details of nutrition and help debunk some of the widely held misconceptions of today (e.g. the gross misconceptions of what causes high blood serum cholesterol, the idea that the RDA vitamin levels are adequate, when and why saturated fat should be avoided, when and why poly-unsaturated fats should be avoided, etc.) Happy reading!

Rick Puetter

II. Supplements of Primary Importance

a. Anti-Oxidants: Vit. A (or betacarotene), C, E, Selenium, Zinc, Manganese...

Free radical damage is the leading theory of at least some forms of aging. Anti-oxidants intercept free radicals (chemicals with extra available electrons) before they damage (oxidize) the cell and its DNA.

Vit. A (betacarotene = pro-vit. A) and C: Water soluble vitamins. Betacarotene protects the skin from sun burn. Vit. C is an important co-factor in protein chemistry and has many other uses.

Vit. E: Oil soluble vitamin. Acts as an anti-oxidant in fat cells, etc.

Minerals: Act as agents in the formation of anti-oxidants. For example, selenium is the limiting mineral in glutathione per oxidase, one of the body's primary anti-oxidants.

Extra vitamin C is recommended, especially if you take Choline and/or Cysteine or are under emotional or physical stress. We take a total of 4 gm of Vit C a day. Note: All vertebrates, with the exception of primates, make their own Vit. C. To have the average Vit. C concentration of the typical vertebrate, a 160 pound person must consume roughly 10 gms of Vit. C per day. We use Trader Joe's anti-oxidant capsules (2 pills morning, 2 pills evening), and Time release Vit. C (1 gm morning, afternoon, evening). Trader Joe's supplement products are very good—compare them to others! Whoever is putting their formulations together, knows what he's doing. They're also extremely inexpensive.

b. B Vitamins: B-1, B-2, B-3, B-5, B-6, B-12

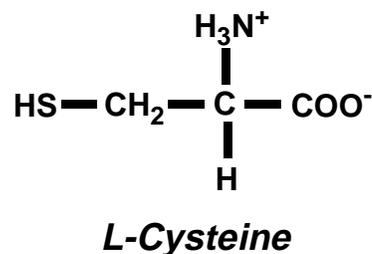
B Vitamins are the primary co-factors in almost all protein chemistry reactions (note that a lot of the B vitamins go by other names, e.g. B-3 = Niacin—there are also a lot of B-Vitamin-like substances, e.g. GABA). So not to have them in abundant supply means that your body cannot efficiently produce the 50,000 known proteins that occur in the human body. We use Trader Joe's time release B-100 capsules (providing 100 mg of most almost all of the B vitamins—B12 in microgram amounts). Take one pill before bed.

c. Minerals: More protein co-factors and anti-oxidant co-factors.

Note: Men do not need any additional iron, especially in the iron fortified American diet. In fact, too much iron in men has been shown to be bad for the heart. In general, minerals should not be taken with anti-oxidants since some constituents will cancel each other out (reactive minerals with oxidize the anti-oxidants). Be sure to use chelated or colloidal minerals. Elemental minerals are almost of no use (less than 10% bio-available). Chelated minerals are roughly 50% bio-available. Colloidal minerals are almost 100% bio-available but are very expensive. We use Trader Joe's multi-minerals (chelated minerals). We recommend taking 2 to 4 pills in the afternoon.

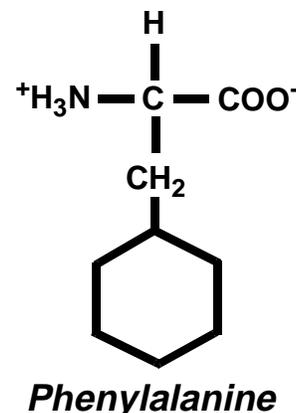
d. Cysteine: Sulfur containing amino acid .

The second amino acid in the sulfur containing amino acid chain (methionine → cysteine → taurine). The sulfur containing amino acids are extremely important. Sulfur-sulfur bonds are largely responsible for the catalytic shape of protein molecules and sulfur is what holds proteins in cell membranes—see essential fatty acids below. Cysteine is normally the limiting amino acid in the formation of glutathione peroxidase, an important anti-oxidant, an antitoxin, an immune system stimulant¹, a cancer preventative², and a neuro-transmitter³. Note, taking glutathione peroxidase directly is expensive, and the body breaks it down before absorption anyway. Available at Henry's. 500 mg in morning. 500 mg in afternoon. Good for hair and skin. Helps some men (10%) with baldness.



e. L-Phenylalanine: Top of the Norepinephrine (nor-adrenaline) cycle

Phenylalanine, “the Pain Reliever”, is one of the 8 essential amino acids. Phenylalanine is one of the aromatic amino acids (the others being tryptophan and tyrosine). Phenylalanine gives energy, especially in the morning, enhances learning, alertness, and memory^{4,5}. Source of important neurotransmitters. 500 mg per day in morning. Available at Henry's. Note: This supplement should not be taken by phenylketonurics. DL-Phenylalanine is also sometimes taken. For this amino (and a few others) the D form is non-toxic and of benefit. The D form is also used as a pain reliever.



f. Chromium Picolinate: Helps with sugar metabolism. Anti-fat nutrient.

Chromium is the limiting trace mineral in glucose tolerance factor (GTF), the substance that determines when the body will bring out more insulin to store blood sugar as fat. Picolinate is the form of niacin that is also used in GTF. Chromium in its trivalent form is well known to cut sugar cravings, increase the basal metabolism, and reduce caloric absorption⁶. We recommend 400 mcg per day equivalent trivalent chromium: 200 mcg in the morning, 200 mcg in the afternoon. Note: Persons with

1. Foster, LH; Sumar, S. “Selenium in health and disease: a review”, *Critical Reviews in Food Science and Nutrition*, 1997, **37**(3): 211-28.
2. Smyth, JF; Bowman, A; Perren, T; Wilkinson, P; Prescott, RJ; Quinn, KJ; Tedeschi, M. “Glutathione reduces the toxicity and improves quality of life of women diagnosed with ovarian cancer treated with cisplatin: results of a double-blind, randomised trial”, *Annals of Oncology*, 1997, **8**(6):569-73.
3. Braverman, ER, et al., “The Healing nutrients within”, (New Canaan, CN: Keats Publishing, 1997)
4. Chiatow, L., “Amino acids in therapy”, (Rochester, VT: Healing Arts Press, 1988) 58-61
5. Braverman, ER, et al., “The Healing nutrients within”, (New Canaan, CN: Keats Publishing, 1997).
6. Khan, A. et al. “Insulin potentiating factors and chromium content of selected foods and spices”, *Biologic Trace Element Res* 1990, **24**, 183-188.

diabetes should consult a doctor before taking this supplement since it affects blood sugar chemistry. However, several studies have shown that chromium picolinate can slow down the onset of diabetes and in some cases reverse it.

g. Broad-Spectrum Amino Acid Supplement.

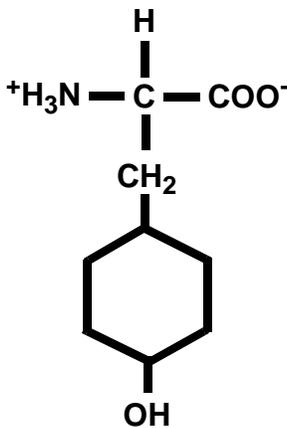
Several varieties are available: pills and powders. Get predigested proteins that have been broken down to free-form amino acids and di- and tri-peptide bonded amino acids. That’s why we’re taking the aminos, i.e. for easy absorption in case the body is having trouble breaking up our food protein or in producing specific amino acids in certain protein-protein chemical reactions. Also, several of the di- and tri-peptide bonded aminos are now suspected of being essential, i.e. needed and unable to be produced by the body.

Amino acids are finding great use in general medicine in various dosages. Some of the uses are listed in Table 1, below.

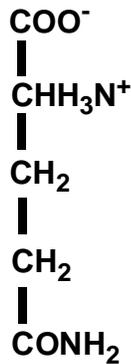
Table 1: Uses of Amino Acids in General Medicine^a

Lower serum cholesterol and triglycerides	Arginine	Methionine	Relieve pain	Methionine	Tryptophan
	Carnitine	Taurine	Fight drug addiction	<i>Amino Acid</i>	<i>Drug</i>
	Glycine			Methionine	Heroin
Release growth hormone, propactin, others	Arginine	Tryptophan		Tyrosine	Cocaine
	Glycine	Valine		Glutamine & GABA	Alcohol
	Ornithine		Control Parkinson’s disease		
Build muscle tissue	Alanine	Isoleucine		Tryptophan	Methionine
	Carnitine	Valine		Tyrosine	GABA
	Leucine			L-Dopa	Threonine
Promote Stamina	Carnitine	Dimethylglycine	Relieve chorea and tardive dyskinesia	GABA	Leucine
Help control diabetes	Alanine	Tryptophan		Isoleucine	Valine
	Cysteine		Help prevent insomnia	Tryptophan	Glycine
Benefit liver patients	Isoleucine	Valine		GABA	
	Leucine		Help control hypoglycemia	Alanine	GABA
Reduce blood pressure	GABA	Tryptophan	Help curb appetite	Arginine	Phenylalanine
	Taurine			Carnitine	Tryptophan
Provide relief for ailing gall bladders	Glycine	Methionine	Calm aggressiveness	GABA	
	Isoleucine	Taurine		Tryptophan	Taurine
	Leucine	Valine		GABA	

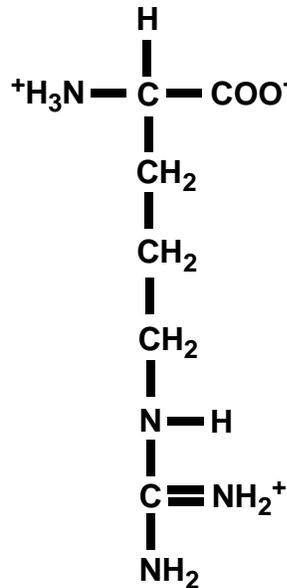
a. Reprinted from “The Healing Nutrients Within”. For details of the use and dosages of the amino acids listed above, see the suggested reading.



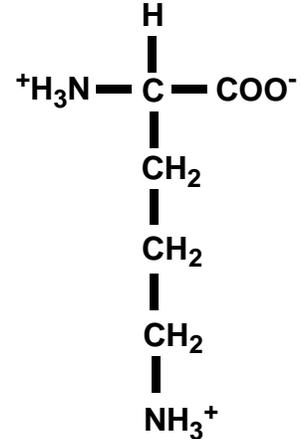
Tyrosine



Glutamine



Arginine



Ornithine

III. Supplements of “Secondary” (???) Importance

h. L-Tyrosine: Amino acid. Neuro-transmitter precursor.

Tyrosine, “The Antidepressant”, is the second step in Norepinephrine cycle. A precursor to important neuro-transmitters and a general stimulant and strengthener of the thyroid. It is a minor growth hormone stimulant and may aid in the correction of mild hypothyroidism¹. We take 500 mg in the morning. Available at Henry’s.

i. L-Glutamine: amino that helps clean out the ammonia from the brain.

Helps with jet lag, memory, and concentration. Studies have shown that students have improved test scores if they take glutamine before exams. Available at Henry’s. We recommend 500 mg in the afternoon.

j. L-Arginine & L-Ornithine: Amino acids from the Urea cycle. Anti-fat nutrients.

These amino acids stimulate the release of growth hormone (GH). This in turn stimulates the immune system and helps the body repair itself. They make the body build protein and burn fat like a teenager, etc. Available at Henry’s. We recommend 5 gm (or more) per day before bed. This is the level found to provide good muscle growth in 50% of the population. Arginine has been tested at 20 gm doses for over 25 years without any harmful effects!. The natural time for release of GH is 1 hour after sleep starts and during and right after exercise. This supplement is normally mixed in a 2 to 1 Arginine to Ornithine ratio. (Ornithine is twice as effective as Arginine in producing GH.) This was the supplement that had the biggest noticeable effect on my body (Rick), dramatically changing muscle tone and producing significant fat loss without changing exercise program or eating habits. For other friends, these supplements had no affect. However, the form discussed below helped even these friends.

The alpha-ketogutarate form of L-ornithine is a popular body building aid. The gutarate molecular skeleton (same chemical skeleton as glutamine—see above) helps the ornithine cross the blood-brain barrier for easier absorption. (Remember Glutamine/Glutamic acid is the primary vehicle for removing ammonia from the brain. That’s why it crosses the blood-brain barrier so easily.) This supplement can be obtained at Henry’s. Twin-Labs GH-Fuel, OKG. Also from Bricker Labs.

1. Chiatow, L., “Amino acids in therapy”, (Rochester, VT: Healing Arts Press, 1988) 58-61.

k. Choline & Inositol: Amino acids. Anti-fat nutrients.

These supplements aid in fat metabolism. Both are liver stimulants. We take these (along with some chromium Picolinate, L-carnitine, methionine, and a few other substances) in a formulation called “Fat Burners”. There are several Fat Burner formulations on the market. All are pretty similar. Buy the cheapest. You can get this at Henry’s. The Fat Burners come in 500 mg pills. Take 4 pills per day (or more—we take 6) in divided doses.

Choline and inositol are also important components of phosphatides, the chemicals that make up every cell membrane in the body. Choline is also the precursor to the important memory neuro-transmitter acetyl-choline. Memory improvement (especially short term memory) is common with choline supplements. Personally, I’ve noticed a large improvement in my memory since taking this supplement.

l. L-Carnitine: Amino acid. Anti-fat nutrient.

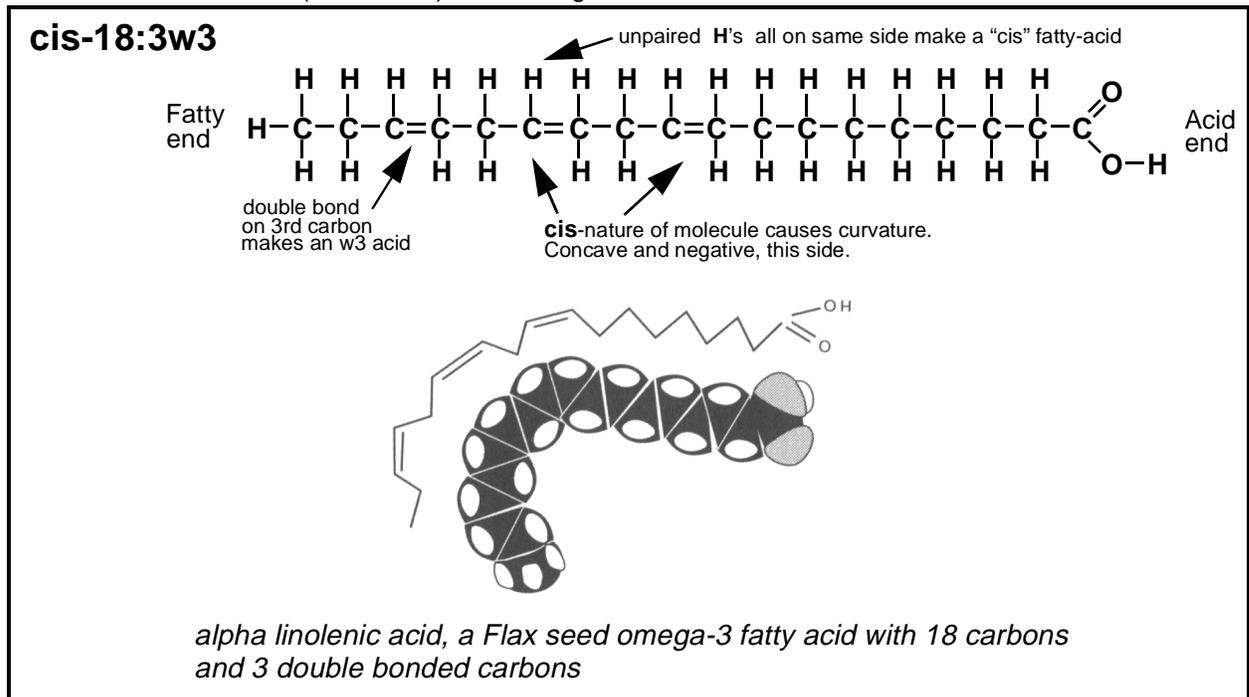
This amino acid helps with fat metabolism. It is important in the transport of free form triglycerides (fats) across mitochondrial membranes in brown adipose tissue. We recommend 500 to 1000 mg per day in divided doses, 1 hour before meals.

m. Flax Seed Oil: Essential Fatty acids (EFAs).

Most of the oils available in the supermarket are heat damaged, non-natural (heat processing has changed them), mildly toxic, trans-fatty acids (i.e. a chemically more stable form of the cis-fatty acids essential to life’s biochemistry). The omega-3 and omega-6 (first double carbon-carbon bond between the 3rd and 4th or between the 6th and 7th carbons respectively) are essential to human life since we do not have the enzymes necessary to make these bonds—we do have the enzymes necessary to make the other important double bonds, e.g. between 9 and 10 (as in olive oil), and between 12 and 13, and between 15 and 16, etc. Without omega-3 fats, you get very sick. Without omega-6, you can die. These fats are precursors to many hormones and prostaglandins (eicosanoids)—see **Fish Oils**, below..

EFAs are essential for healthy cell membranes (increase cell membrane fluidity and cell metabolism—the electrically charged, curved, cis-fatty acids hold protein enzymes in the cell membranes through sulfur bonds—see Figure 1). They also reduce fatty build-up in the arteries—yes, these fats actually remove fat! Take 1 to 2 gm per day. Excellent tasting oil for salad dressing if you want to avoid pills, but it spoils easily unless kept in the dark and in the refrigerator. Available at Henry’s.

There’s Lots of linolenic (cis-18:3w3) and other good fats in Flax Seed Oil!



n. Evening Primrose Oil: Gamma linolenic acid. Anti-Fat Nutrient.

This fat stimulates fat burning. Evening Primrose oil is also a source of essential fatty acids. It also helps women with menstrual problems. 1 to 2 gm per day. Get at Trader Joe's

o. Fish Oils: Highly unsaturated fats from cold water fish.

Fish oils from cold water fish provide some of the most highly unsaturated natural fats around—cold water fish require highly unsaturated fats so that they remain liquid at the cold temperatures of the water they live in. These fats help clear out the arteries by replacing the more solid saturated fats. They are especially useful in promoting the “good” eicosanoid (prostaglandin) families. (Eicosanoid are hormone-like substances containing 20 carbon atoms. They arise from the essential fatty acid oils we consume.) The E2 family of eicosanoids are now thought by many to be responsible for a variety modern health problems. (Stay away from sugar and don't over-eating carbohydrates as this stimulates lots of insulin and promotes the E2 family—see Eades and Eades and/or Erasmus in the suggested reading.) The E1 family (and E3 family), on the other hand, are thought to aid substantially with health (see Table 2).

Linoleic acid (cis-18:2w6) is the normal starting point for the formation of the eicosanoids. Conversion of linoleic acid (LA) to the E1 eicosanoid family is blocked by trans-fatty acids (watch out for these, they're everywhere these days, especially in margarine), alpha linolenic acid (ALA), and a high carbohydrate diet.

Note that there is a lot of ALA in flax seed oil. So what's going on here? Is flax seed oil good for you or not? Well, there's currently a lot of argument over this. It blocks E1 formation, but is normally necessary for E3 eicosanoid formation (it's at the top of the E3 family tree). However, flax seed oil seems to be good for lots of things, and many researchers feel that it is the total balance between the omega-3 fatty acid ALA and the omega-6 fatty acid LA that is important. However, if you're concerned, fish oils rich in eicosapen-

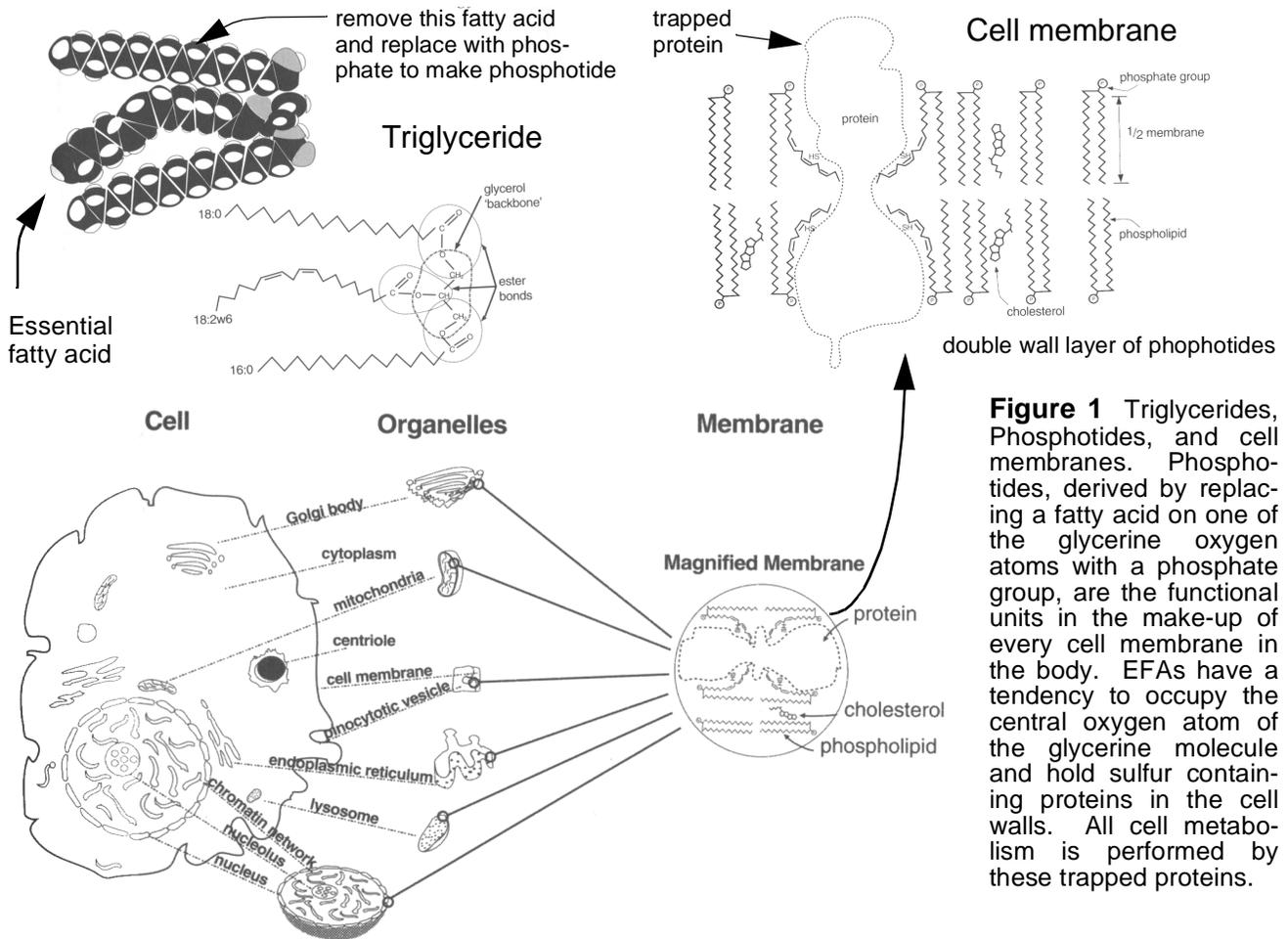


Figure 1 Triglycerides, Phospholipids, and cell membranes. Phospholipids, derived by replacing a fatty acid on one of the glycerine oxygen atoms with a phosphate group, are the functional units in the make-up of every cell membrane in the body. EFAs have a tendency to occupy the central oxygen atom of the glycerine molecule and hold sulfur containing proteins in the cell walls. All cell metabolism is performed by these trapped proteins.

taenoic acid (EPA, 20:5w3) might be a nice supplement to LA rich oils. EPA helps to deactivate delta 5 desaturase¹, the step required to form arachidonic acid, which is at the top of the E2 eicosanoid chain and directly feeds the E3 eicosanoids.

Table 2: Effects of E1 and E2 Eicosanoid Families

E1, the “Good” Eicosanoids	E2, the “Bad” Eicosanoids
act as vasodilators	act as vasoconstrictors
act as immune system enhancers	act as immune system suppressors
decreases inflammation	increases inflammation
decreases pain	increases pain
increases oxygen flow	decreases oxygen flow
increases endurance	decreases endurance
prevents platelet aggregation	causes platelet aggregation
dialates airways	constricts airways
decreases cellular proliferation	increases cellular proliferation

p. DMAE (Di-methyl amino ethanol): Smart drug.

This is a very effective, over-the-counter smart drug that can improve your memory—it has improved mine! It is naturally occurring in fish, i.e. “brain food”. DMAE elevates mood, improves memory and learning, increases intelligence, and has been found to extend the life span of laboratory animals. Riker Laboratories has developed a prescription drug (Deaner or Deanol) which is a p-acetamidobenzoate salt of DMAE and which has very similar effects. Riker markets this drug for the treatment of learning problems, underachievement, shortened attention span, hyperactivity, reading and speech difficulties, impaired motor coordination, and behavior problems in children. DMAE works by accelerating the brain’s synthesis of the neuro-transmitter acetylcholine, which plays a key role in maximizing mental ability as well as preventing loss of memory in aging adults. Available at Henry’s.

q. Melatonin: Anti-oxidant, sleep promoter, immune system stimulant

Melatonin is the most powerful hydroxyl radical scavenger known². It is an ancient, simple, hormone-like substance that many think was the precursor to glutathione peroxidase early in the evolution of lifeforms. It has also been linked to strengthening of the immune system and for help to prevent premature aging^{3,4,5}. Taking it for these benefits is probably the best reason for taking melatonin, but many take it for its sleep promoting properties. It is also a precursor to serotonin, the sleep hormone. It is useful for jet-lag and resets the body’s internal clock. It is produced by the pineal gland. Teenagers produce roughly 12 mg/day of the stuff. Production of melatonin falls off rapidly after the age of 20. Standard pill does are 3 mg/pill. We take 1 pill in the evening before bed. I’ve also found an extra pill (or two) helpful in getting to sleep on a restless night. Some people find it makes them groggy in the morning. Usually this passes as the body becomes accustomed to the supplement. Available at Henry’s.

r. DHEA: Hormone precursor, anti-cancer agent, anti-fat nutrient

This is a true wonder supplement. It is a simple hormone precursor that has almost 100% absorption in the body by oral administration. This was just recently allowed by the FDA to be sold over the counter. In women it is a precursor to estrogen, in men to testosterone (although high doses does produce facial hair in women—doses in excess of 100 mg/day). A number of studies have demonstrated that this is an effective anti-cancer agent. It is also well demonstrated as a weight loss agent—it returns the body to its youth-

1. “EPA is the most important factor limiting PG2 (eicosanoid family 2) production...” from *Fats that Heal, Fats that Kill*, Erasmus—see suggested reading.
2. Reiter RJ; Tan DX; Poeggeler B; Menendez-Pelaez A; Chen LD; Saarela S, “Melatonin as a free radical scavenger: implications for aging and age-related diseases”, *Ann N Y Acad Sci* 1994; **719**: 1-12
3. Maestroni GJ, “The immunoneuroendocrine role of melatonin”, *J Pineal Res* 1993; **14(1)**: 1-10.
4. Pierpaoli W; Lesnikov VA, “The pineal aging clock. Evidence, models, mechanisms, interventions”, *Ann N Y Acad Sci* 1994; **31**; 719:461-73.
5. Poon AM; Liu ZM; Pang CS; Brown GM; Pang SF, “Evidence for a direct action of melatonin on the immune system”, *Biol Signals* 1994; **3(2)**: 107-17

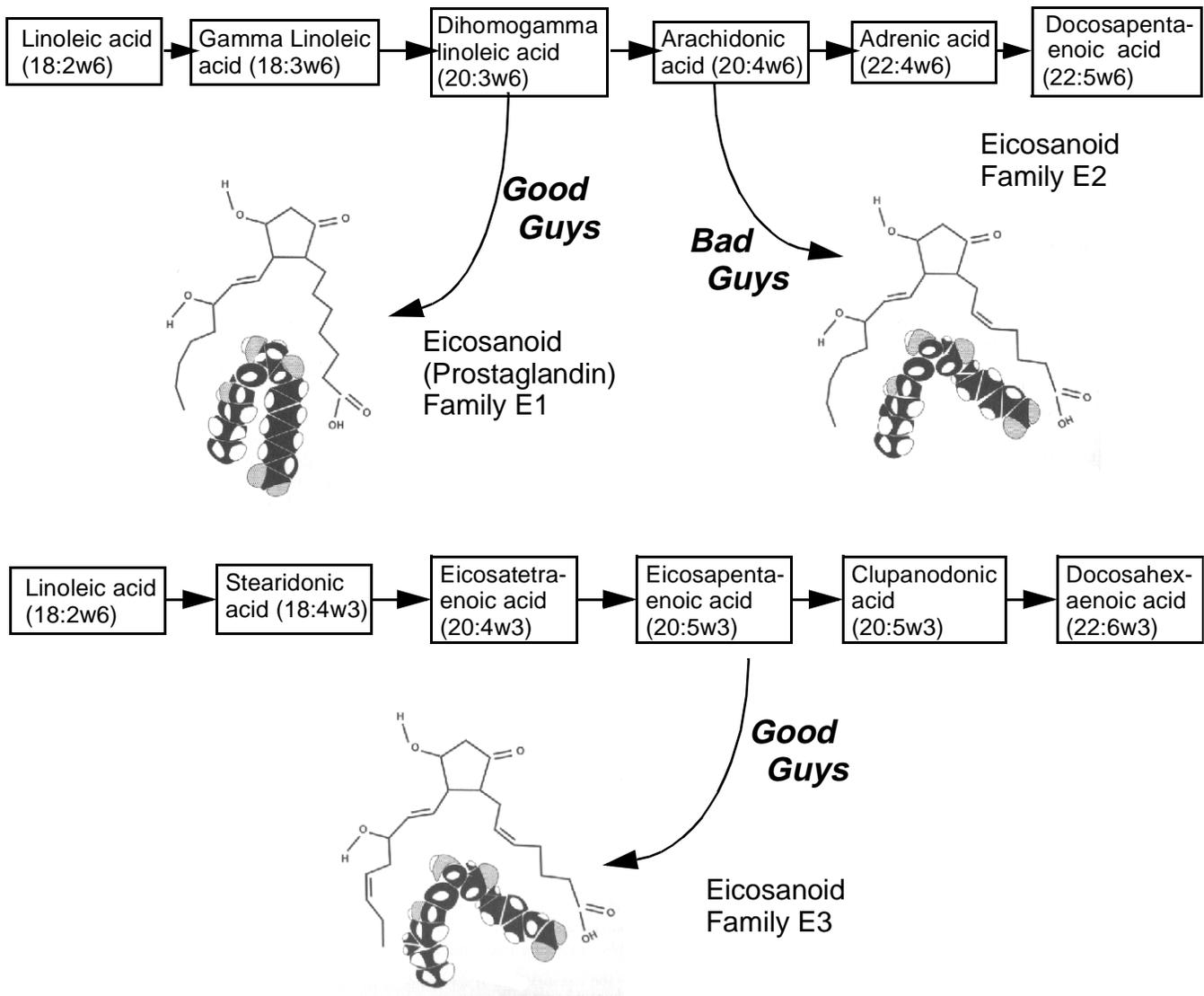
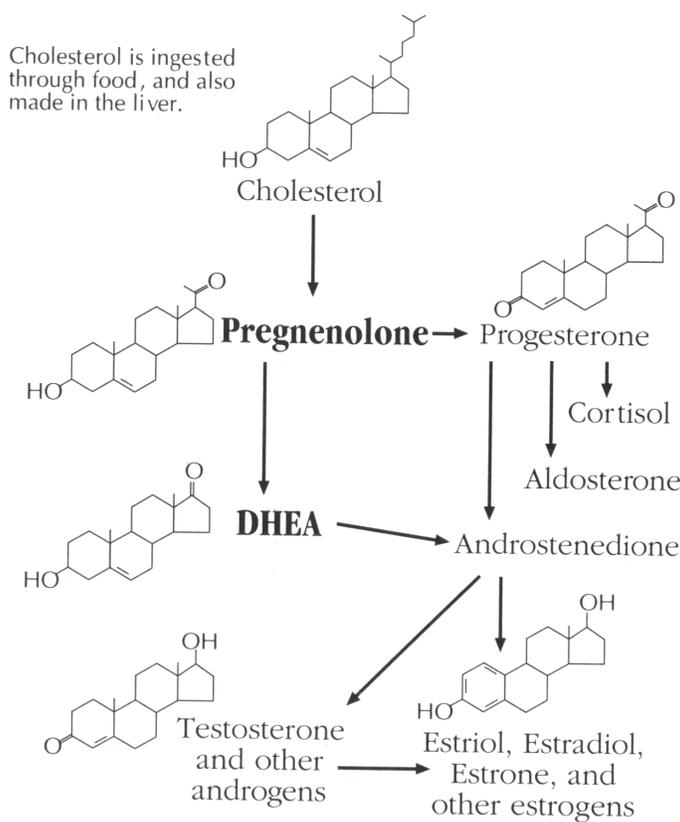


Figure 2 Manufacture of Eicosanoids (prostaglandins) in the body from essential fatty acids.

ful ways. Animal studies of this substance are extensive and astounding. It seems good for almost everything. Human studies are just seriously beginning. Results of these studies are often contradictory (small numbers of persons are often used in the study and controlling the subjects is harder than for mice!). Nonetheless, my reading of the literature seems to show the majority of studies show DHEA beneficial for most things, including cancer of all types^{1,2,3}, immune system stimulation^{4,5}, increased energy⁶, more rapid muscle growth, mood enhancement⁷, improved mental function^{8,9,10}, and weight loss¹¹.



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Please note that
some metabolic steps
have been skipped in
order to simplify
this diagram

s.HMB (β -hydroxy β -methyl butarate): Protein break-down suppressor

Okay body-building enthusiasts! The next two supplements are what you've been waiting for. I've tried them and they're dynamite. First, HMB.

It has been known for a long time that the branched chain amino acids, leucine, isoleucine, and valine—see chart, are extremely beneficial in promoting muscle growth and recovery from hard exercise. Leucine, in particular, was found to be especially good. Recently a group at the University of Iowa has discovered that the benefits of the branch chained aminos is probably due to a specific metabolite of leucine, β -hydroxy β -methyl butarate. This specific metabolite has been patented by the University of Iowa and is now being sold by several supplement companies. Clinical tests have shown that this supplement grows muscles 300% faster than without such supplementation. This is as good (or better) than the results achieved with anabolic steroids. And HMB doesn't have any of the negative health problems of steroid, e.g. liver damage, heart problems, high blood pressure.

I've used branched chain amino fortified protein drinks before. These halved my

recovery time in the gym, from two days to one day. HMB is MUCH better. Recovery time is now about 1/2 day and there is practically no soreness even after extremely hard workouts. And the muscle growth is tremendous.

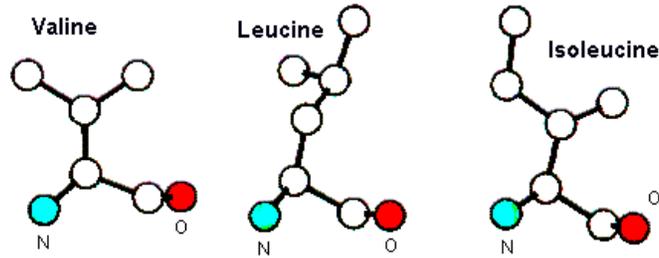
1. Luo S, Labrie C, Belanger A, Labrie F, "Effect of dehydroepiandrosterone on bone mass, serum lipids, and dimethylbenz(a)anthracene-induced mammary carcinoma in the rat", *Endocrinology* 1997; **138**(8): 3387-3394.
2. Perkins SN, Hursting SD, Haines DC, James SJ, Miller BJ, Phang JM, "Chemoprevention of spontaneous tumorigenesis in nullizygous p53-deficient mice by dehydroepiandrosterone and its analog 16alpha-fluoro-5-androsten-17-one", *Carcinogenesis* 1997; **18**(5): 989-994.
3. Kohama T, Terada S, Suzuki N, Inoue M, "Effects of dehydroepiandrosterone and other sex steroid hormones on mammary carcinogenesis by direct injection of 7,12-dimethylbenz(a) anthracene (DMBA) in hyperprolactinemic female rats", *Breast Cancer Res Treat* 1997; **43**(2): 105-115 .
4. Suitters AJ, Shaw S, Wales MR, Porter JP, Leonard J, Woodger R, Brand H, Bodmer M, Foulkes R, "Immune enhancing effects of dehydroepiandrosterone and dehydroepiandrosterone sulphate and the role of steroid sulphatase", *Immunology* 1997; **91**(2): 314-321.
5. Shealy CN, "A review of dehydroepiandrosterone (DHEA)", *Integr Physiol Behav Sci* 1995; **30**(4): 308-313.
6. Watson RR, Huls A, Araghnikiam M, Chung S, "Dehydroepiandrosterone and diseases of aging", *Drugs Aging* 1996; **9**(4): 274-291.
7. Prasad A, Imamura M, Prasad C, "Dehydroepiandrosterone decreases behavioral despair in high- but not low-anxiety rats", *Physiol Behav* 1997 **62**(5): 1053-1057.
8. Rupprecht R, "The neuropsychopharmacological potential of neuroactive steroids", *J Psychiatr Res* 1997; **31**(3): 297-314 .
9. Friess E, Trachsel L, Guldner J, Schier T, Steiger A, Holsboer F, "DHEA administration increases rapid eye movement sleep and EEG power in the sigma frequency range", *Am J Physiol* 1995; **268**(1 Pt 1): E107-E113.
10. Flood JF, Morley JE, Roberts E, "Memory-enhancing effects in male mice of pregnenolone and steroids metabolically derived from it", *Proc Natl Acad Sci U S A* 1992; **89**(5): 1567-1571.
11. Hansen PA, Han DH, Nolte LA, Chen M, Holloszy JO, "DHEA protects against visceral obesity and muscle insulin resistance in rats fed a high-fat diet", *Am J Physiol* 1997; **273** (5 Pt 2): R1704-R1708

t. Creatine Phosphate: Muscle growth

Creatine monohydrate has long been a solid weight training supplement. Creatine is a precursor of ATP, the source of cellular energy. Muscle cells have a huge capacity to absorb creatine and thus have a ready reserve for ATP production. Most clinical studies have been done with creatine monohydrate. They have clearly demonstrated the great increase in muscle energy and reduction in muscle fatigue.

This allows for deeper working of the muscle in the gym, which probably accounts for part of the enhanced muscle growth. In addition, however, creatine helps the muscle to saturate with water. It is thought that this improves the conditions for muscle growth. In any event, I've found creatine to be exceptionally good. I feel strong when I take it and can work much harder at the gym. Even after hard sets, recovery is very rapid and I can perform repeat sets. I'm using creatine phosphate rather than the monohydrate form—which seems to be the new rage in the industry. This makes sense since the creatine must join with phosphate to form ATP.

The Branched chain amino acids



u. Methylation, Folic Acid (Folate), B-12, Trimethylglycine, & S-Adenosylmethionine

Recent research indicates that the physiological process known as methylation is directly related to many diseases, including cancer, heart disease, liver disease, osteoarthritis, and neurological disorders (e.g. Alzheimer's disease). Furthermore, methylation also appears to play a significant role in the aging process in general and is how the action of DNA is made specific to the cells in given locations in the body (i.e. how liver cells know to become liver cells even though they have all the genetic details for becoming cells appropriate to the eyes, hair, teeth, etc.). Methylation can be enhanced or inhibited through diet, life-style factors (such as smoking, drinking and taking birth control pills which decrease methylation), and direct supplementation, primarily with folic acid, B-12 and trimethylglycine (TMG).

Methylation is the process by which methyl groups attach to different substances in the body, working to either protect or transform them. Methyl groups convert homocysteine (HCY), a toxic amino acid which can cause heart disease and vascular disease, to methionine, a beneficial amino acid. Methionine produces SAM-e (S-adenosylmethionine) a natural anti-depressant and methyl donor, that is a supply house of methyl groups. Elevation of SAM-e is beneficial in both the prevention and treatment of a variety of liver disorders, including those caused by alcohol stress.

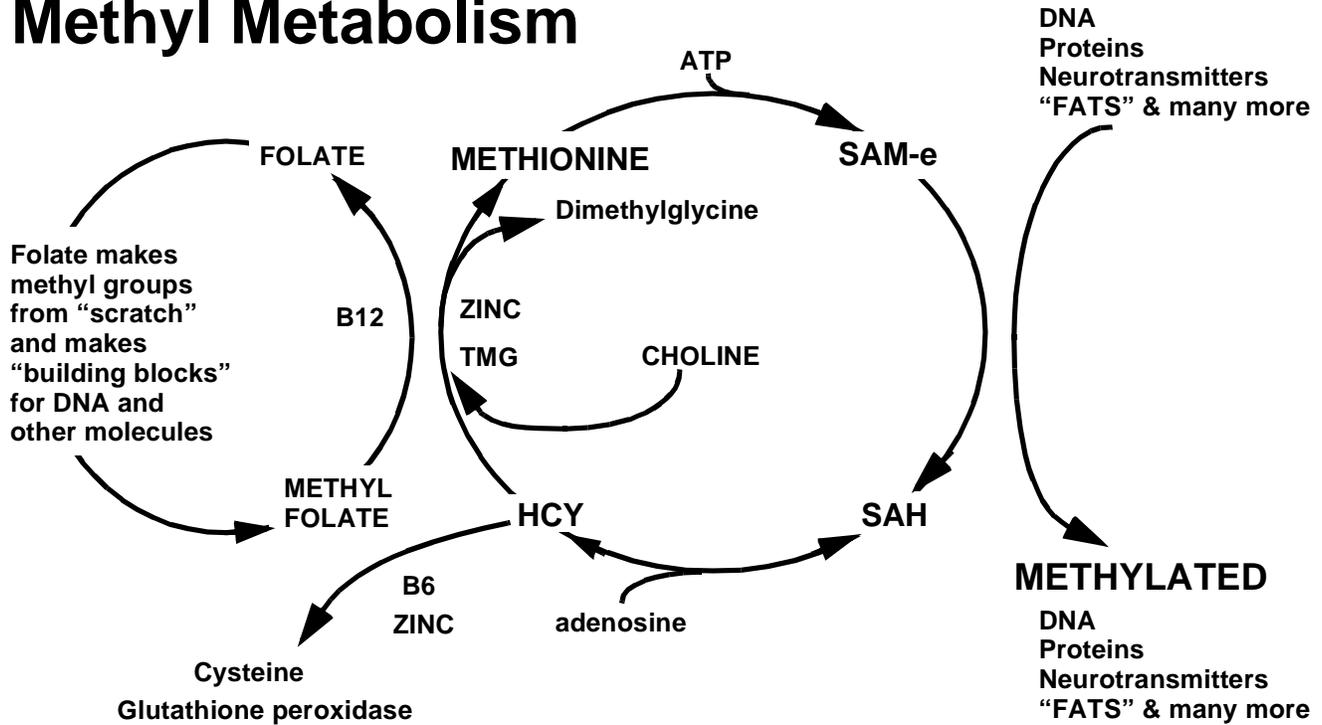
Methylation is a naturally occurring process; however, the presence of methyl groups is inversely correlated with the aging process. As animals age, they lose methyl groups from their DNA, and their ability to replace methyl groups (or methylate) is decreased. Factors that can be used to enhance methylation are diets high in methyl group sources such as TMG and folic acid (with B12).

There are many benefits of methylation. Helping prevent heart disease, cancer, liver disease, depression and perhaps slowing down the perennial human condition of aging are some of the many possibilities. Lowering homocysteine, protecting DNA, and producing SAM-e are the three ways that methylation works to improve health.

Trimethylglycine (TMG) is the newest and most effective methylation enhancing compound, and is commonly known as betaine, glycine betaine, or oxynurine. (Several companies have mistakenly labeled betaine HCL as TMG. TMG is not the same as betaine HCL, which acts as a stomach acidifier and is not practical due to stomach irritation at the doses required to enhance methylation metabolism). Trimethylglycine (TMG) is the most effective methylation enhancing agent known. After TMG converts toxic homocysteine into methionine and SAM-e, it becomes DMG (dimethylglycine), the first nutrient performance enhancer sold in the United States in health food stores.

SAM-e has been shown in clinical studies to be the fastest acting, safest, and possibly, most effective anti-depressant ever found. One study found that 66% of patients treated with SAM-e showed significant clinical improvement in depressive symptoms compared only 22% of patients given the antidepressant drug imipramine. Unlike conventional antidepressant drugs that produce adverse side effects, SAM-e produces multiple health benefits and may slow the aging process.

Methyl Metabolism



Reproduced from "Methyl Magic", Craig Cooney, PhD., 1999.

SAM-e is sold in Europe as a drug for the treatment of depression and liver disease. The European version of SAME is cost prohibitive for most people. The cost of an effective dose (1200-1600 mg) for treating most forms of depression and acute liver disease is \$9 to \$12 a day. Unlike many drugs that have inflated prices, SAM-e is genuinely very expensive to synthesize. It takes many kilos of methionine to produce 1 kilo of SAM-e. Stability in manufacturing and packaging are further problems that add to the cost of SAM-e. Supplementation with Folate (500-800 mcg per day), B-12 (500-100 mcg per day), and TMG (1000 mg per day) is a cheaper way of increasing the natural level of SAM-e in the body. (This prescription assumes already healthy levels of Choline—another "methyl donor" that helps to lower elevated homocysteine levels and doesn't require co-factors—and Zinc.)

Suggested Nutrition References

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| Eric Braverman
& Carl Pfeiffer | <i>"The Healing Nutrients Within"</i>
1987, Keats Publishing
(second Edition 1997) | This is a relatively old book, but it is the very best reference that I have found regarding Amino acids. Braverman works with Pfeiffer at the Brain Bio Center in NY (Center which treats mental ailments with amino acid therapy) and is the Director of Research at the Atkins Center, New York City. Pfeiffer is the Director of the Brain Bio Center. |
| Dallas Clouatre | <i>"Anti-Fat Nutrients"</i>
1993, Pax Publishing | This book provides a concise summary of anti-fat nutrients and how they work. Excellent for anyone who wants to lose some weight and get healthier in the process. |
| Michael Colgan | <i>"Optimum Sports Nutrition"</i>
1993, Advanced Research Press | Excellent book especially for athletes. Good summary of amino acids, vitamins, etc. Discusses effects of exercise as well. Colgan is a recognized sports trainer for sports professionals and Olympic athletes. |
| Craig Cooney,
PhD. | <i>"Methyl Magic"</i>
1999, Andrews McMeel Publishing | This is one of several new good books on methylation and how important it is in the body. Talks extensively about SAM-e, lowering homocysteine, cancer, depression, mental health, and arthritis. Goes into some of the physical mechanisms. Lots of references for further research. Gives recipes and supplementation recommendations. |
| Ward Dean &
John Morgenthaler | <i>"Smart Drugs"</i> | A very comprehensive review of over the counter, prescription, and drugs available in Europe that can be used to enhance your memory and improve your intelligence. The book contains extensive references and presents the results of numerous studies related to a variety of mental ailments, including Alzheimer's disease, amnesia, etc. |
| Michael R. Eades,
MD, and Mary
Dan Eades, MD | <i>"Protein Power"</i>
1996, Bantam Books | One of the most informative of the new "High Protein Diet" books. This one gives facts, not religion. Talks extensively about the Eicosanoid families, E1, E2, and E3, and their role in health and the roles of proteins and fats in their effects on the body. |
| Udo Erasmus | <i>"Oils and Fats"</i>
1986, Alive Books | Extremely good book outlining the biochemistry of fats and oils. Demystifies fats and points out common misconceptions of the medical community and society at large regarding fats. Discusses good fats and how to get them and how to avoid bad fats (especially those now advertised as healthy by the medical profession—this includes most fats found in stores). A second edition of this book is now also available: <i>"Fats that Heal, Fats that Kill"</i> . |
| Robert Erdmann | <i>"The Amino Revolution"</i>
1987, Simon & Schuster | Another good amino acid reference from a PH.D. nutritionist. Not quite as complete as <i>"Healing Nutrient Within"</i> , but covering some different topics. |
| Daniel Mowrey | <i>"Fat Management"</i>
1994, Victory Publications | A very interesting and thorough book describing the function and purpose of brown fat (brown adipose tissue) and how this organ of the body is the body's natural calorie waster. Describes how to stimulate and grow new brown adipose tissue to become leaner and healthier. (Loss of brown adipose tissue and function is one of the primary reasons people gain weight as they age.) Extremely good exposition of how the body burns fat and generates energy, etc. |
| Durk Pearson &
Sandy Shaw | <i>"Life Extension"</i> | This is the pioneering work that started the nutrition craze in the mid 1980's. Still a very good reference work. Lots of information in this roughly 900 page paper-back book. Also an easy reference to get your hands on. It's carried in lots of stores. |
| Carl Pfeiffer | <i>"Mental and Elemental Nutrients"</i>
1975, Keats Publishing | Earlier, historic work by Pfeiffer describing the uses of vitamins and trace minerals. |
| Jay Robb | <i>"The Fat Burning Diet"</i>
1994, Loving Health Publications | An interesting book that describes why carbohydrates are bad for the body—in fact that's why the body had to develop an insulin defense against the too rapid burning carbohydrates. Describes how to lose weight by eating a high protein and fat diet. |