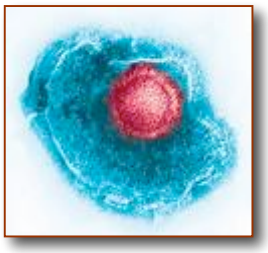
Cell Nutritionals™
Nourishing cells for life.

A Nutritional Approach to Creating & Maintaining Constant Health

August 2014

Nutrition at the Cellular Level

So we understand what's happening at a *macro* level, but what is less understood is the role cellular nutrition plays in good health at the *micro* level.



Many recent Nobel Prizes in science have been awarded to scientists studying cell-to-cell communication, in fields ranging from medicine and physiology to biology and chemistry.

Understanding how cells work is essential to protecting health. In nutritional science, the focus is on providing energy and information. This is accomplished through intake of nutrition sufficient to allow cells *to determine for themselves* what they need to function optimally.

When toxins or contaminants are ingested, they can cause cellular mutations in the intestine. Dietary fibers work to sweep toxins through and out of the intestine. When diets are deficient in fibers, toxic loads increase and the body must work harder to detoxify.

Toxins are defined as "harmful substances accumulating in the body." Common toxins include: dangerous bacteria, pesticides, preservatives, over-the-counter and prescription drugs, hormones, and other industrial chemicals that make their way into our food and water supplies.

In the presence of toxins the body signals the intestine to rapidly replace its epithelial (surface) cells. This is to heal possible damage to the intestinal lining and to prevent toxins from being absorbed into the body.

Nutrients across cell membranes

Cell Membranes & Fatty Acids – Human cells are bound by a semi-permeable membrane composed of phospholipids. Phospholipids are primarily fatty acids coupled with a phosphate group and an organic molecule. A healthy cell membrane allows nutrients and essential molecules to pass through, while prohibiting harmful toxins from entering the cell. The cell membrane essentially allows cells to talk to one another.

The type of fatty acid in cell membranes is directly correlated to the kind of fat consumed in the diet. Saturated fatty acids become incorporated into fluid cell membranes and pack in very tightly. Since saturated fatty acid chains have no gaps, they effectively prevent nutrients from entering cells.

Optimal cell membrane composition is achieved when the diet is comprised of equal parts saturated and unsaturated fatty acids. Unfortunately, many Westerners eat three times the recommended amount of saturated fats, and far too many disruptive

hydrogenated and trans fats. This leads to oxidized fats and accompanying damage to cell membranes.

Cell Membrane Damage – With damage to its membrane, a cell's ability to regulate itself is at risk. Nutrient and electrolyte intake, excretion of wastes, communication with other cells, and reception of signals are then impinged upon.

Moreover, leaky cell membranes allow damaging toxins, especially fat-soluble toxins (such as pesticides) to cross both the cell's outer membrane and the inner nuclear membrane. When this happens, a cell's DNA and energy-producing mitochondria become vulnerable to free radicals and potentially dangerous mutations.

Cell Nucleus – Most of a cell's genetic material, DNA molecules organized into chromosomes, is contained in the cell nucleus. The nucleus is responsible for regulating gene expression (DNA and cell replication) and protecting gene integrity.

Cell Mitochondria – Mitochondria are the energy-producing workhorses of the cellular world. Depending on metabolic requirements, cells have anywhere from one large mitochondrion to thousands of smaller mitochondria. The central role of mitochondria is to produce ATP (adenosine triphosphate) from glucose for energy.

In addition to energy production, some mitochondrial functions are specific to certain cells. For example, the mitochondria in liver cells detoxify ammonia, a waste product from protein metabolism. Mitochondria also play important roles in metabolic functions, such as cell-programmed suicide (apoptosis). This process ensures billions of cells damaged beyond repair die so new healthy cells can be generated. These damaged cells include those infected with viruses and DNA impairment.

Finally, metabolic disturbances can also negatively affect mitochondria. This occurs during glycation (sugar molecules bonding to protein or lipid molecules without the controlling action of an enzyme). This also occurs during periods of high glucose levels, when glucose molecules bind to proteins in the mitochondria of cells. Sugar-coated proteins, or glycoproteins, distort mitochondrial function. They also produce excessive free radicals, harming cells and creating a "metabolic memory" for a diabetic state, even after high glucose levels return to normal.[1]

[1] Warwick Medical School, June 2007

Fighting "Cellular TOIL"

Cell Nutritionals' medical advisor, Hugo Rodier, a leading integrative M.D., stresses four essential things cells must manage to maintain health. They are: toxicity, oxidation, inflammation, and mitochondrial energy conversion.

Typical Western diets lead to a condition of constant "cellular TOIL," which means cells suffer from:

- **Toxicity** – Every cell in the body excretes waste endogenously (from within). If cells can't eliminate this waste properly on their own, it stays in the body and becomes toxic. When exogenous (from the outside) toxins are ingested (i.e., hormones, pesticides, heavy metals, etc.), they add to toxic loads, which leads to cell communication problems. The more toxins absorbed and created metabolically, the harder cells must work to detoxify.
- **Oxidation** – Free radicals are reactive electrons produced by normal metabolic oxidation processes. However, excessive free radical formation can wreak havoc by stealing electrons from and destabilizing healthy atoms and cause oxidative stress that damages all cell components. Oxidized lipids, sugars, enzymes, and proteins then stop functioning properly and become harmful waste products in their oxidized states in cells.
- **Irritation** – Damaged cell membranes become irritated and inflamed. This leads to a progressive shift in the type of cells that are present. This condition is characterized by a release of toxins and free radicals, which causes still more membrane inflammation. As a result, chronically inflamed cell membranes can't communicate properly. Without adequate cellular communication, hormones, neurotransmitters, and enzymes can't organize body functions properly. Vascular tissues then respond to harmful stimuli from damaged cells by becoming inflamed themselves, making inflammation a vicious cycle of escalation.
- **Less than optimal mitochondrial energy** – Most health problems also include a breakdown in how mitochondria, the energy sources for cells, do their job. Without the right nutrients, fragile mitochondria become underpowered and a whole chain reaction of energy shortages takes place—in muscles, in tissue regeneration after injury, and even to facilitate complex coordination among cells.

All four components of TOIL interplay with one another. Oxidative and inflammatory damage to the mitochondria in nerve tissues, creating neuropathy, is a key problem in diabetes. Oxidation of mitochondria is also quite prevalent in neurodegenerative diseases like Alzheimer's and Parkinson's diseases.

Refined diets are low in B complex vitamins like folic acid, which increases oxidation of our DNA and our cell membranes. Environmental toxins, which deplete our supply of B complex vitamins, act like free radicals by scavenging cell membranes in our

mitochondrial and systemic cell membranes. The more we lack antioxidants, particularly glutathione, the more atherosclerotic lesions we develop on our arterial walls, and so on.

The Science Behind Constant Health Daily™

Creating genuine, lasting health requires a comprehensive array of nutrients. Constant Health Daily™ is Cell Nutritionals' all-in-one daily health-boosting product, containing nearly four dozen natural ingredients carefully blended to provide:

- **Gentle Rice Protein & Cellular Energy Builders** – Gentle, easy-to-digest rice protein with low-allergenic potential (always gluten-free) that has vitamins, minerals, and other nutrients that support overall cellular renewal and energy production.
- **Liver Detoxifiers, Intestinal Builders, and Digestive Aids** – A combination of amino acids that boost glutathione levels, along with fibers and other agents that help detoxify the body of heavy metals, chemicals, pesticides, and xenoestrogens, which disrupt sexual function and the endocrine system. Intestinal soothing agents also support healthy nerve endings in the stomach and renewal of intestinal cells (which form the vital mucosal lining where nutrients are absorbed and toxins get blocked from circulating throughout the body).
- **Immune System Builders (Antioxidants & Phytonutrients)** – A powerful suite of antioxidants and phytonutrients supporting healthy immune system function. With most of the immune system located in the gut, the formula's focus on healing the gut and eliminating toxins stored in fat cells also supports immune system function as well.
- **Joint & Bone Builders –** Use of vegetarian glucosamine and MSM along with extra vitamin B6 and turmeric to support joint renewal and comfort. Inclusion of calcium, magnesium, boron, vitamin D3 and vitamin K2 for strong bones.
- **Natural Sweeteners** – All-natural sweeteners and flavorings that create an appealing formula while delivering concentrated nutrition.

How to Use Constant Health Daily™

Constant Health Daily™ yields approximately 37.86 grams of concentrated nutrition per serving (two scoops). Constant Health Daily™ may be used at three different levels for optimal effect.

Level 1 - Daily Nutrition Booster (1 scoop): This level is for people who like to tailor their supplements with a variety of products. They are looking for a solid booster for healthy immune, intestinal, and detoxification function without adding a lot of additional products.

Level 2- For Concentrated Daily Nutrition (2 scoops): This level is for people who take few or no other supplements and want one basic formula that covers a variety of needs. This level is for those who appreciate a formula that supports their health in one easy way (ideal for travelers and on-the-go nutrition) and likewise for those who would like to cut down on the number of tablets and capsules they have to swallow.

Constant Health Daily™ was designed as a foundation for a comprehensive nutritional program. It combines the benefits of four key components of nutrition: gentle protein and amino acids; detoxifiers and intestinal builders; antioxidants and phytonutrients; and nutrition for cellular energy and metabolic processes. (See Figure 1)

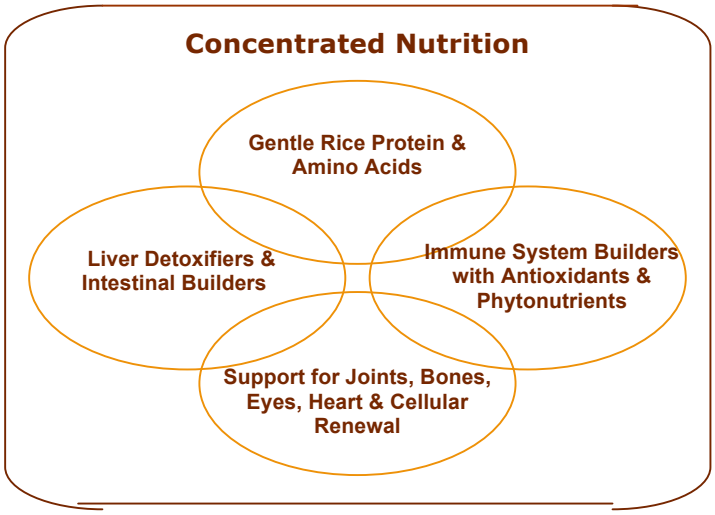


Figure 1 – Four Components of Constant Health Daily™

Details on the Constant Health Daily™ Formula

Benefits of Rice Protein

Constant Health Daily™ offers a complete rice protein, which digests easily and is one of the few hypoallergenic protein sources. It compares favorably to dairy-based whey, egg, and soy proteins. Rice protein is very gentle and has been used successfully in populations with sensitive systems, including infants and the elderly.

Wide-scale epidemiological studies[2] support the use of plant proteins for optimizing health. Many people choose to also increase their intake of protein, and it's recommended that the elderly, in particular, add supplemental protein to their diets. Rice protein is, of course, perfect for those adopting a vegetarian program.

A Complete Protein

[2] *The China Study*, T.C. & T. M.Campbell, 2005

Protein is the main component of muscles, tendons, ligaments, organs, and glands. Every living cell and all body fluids, with the exception of bile and urine, contain protein.

Rice yields the highest quality protein of all grains and has a neutral taste that doesn't require masking agents for palatability.

Some wonder how rice, a carbohydrate, can yield a complete protein. The fact is all foods, including vegetables and fruits, contain amino acids, the building blocks of protein. Protein is isolated from the carbohydrate molecules in brown rice to produce rice protein. To be considered a complete protein, a protein must have all nine essential amino acids. Rice protein qualifies as a complete protein, and includes all non-essential amino acids as well.

Proteins & Amino Acids

Proteins are essential to all living cells. In fact, all the millions of different proteins in living organisms form by bonding only 20 building blocks called amino acids. As large molecules in the human body, proteins include vital agents like enzymes (catalysts for digestion), neurotransmitters (dopamine and acetylcholine), hormones (insulin and human growth hormone), and antibodies.

Growth, repair, and maintenance of cells are all dependent upon digestion of proteins into constituent amino acids in the gastrointestinal tract. These amino acids are then distributed to cells, which work to assemble proteins required for specific functions, like keratin for skin and collagen for tendons.

Organs with active metabolisms (liver, kidney, intestinal mucosa, and pancreas) have especially high requirements for protein. Stress to the body, such as intensive exercise, wounds, infections, surgery, even aging, also increases the body's protein requirements.

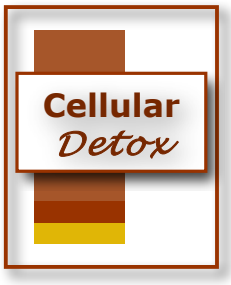
However, antibacterial agents and toxins can inhibit cells from synthesizing proteins that they need to function. Poor protein metabolism can also cause toxic levels of waste ammonia, putting undue stress on the kidneys and liver.

Many popular diets subscribe to the theory of "more protein" and "fewer carbohydrates." However, most diets pay little attention to the *quality* of the protein being ingested.

Animal proteins are much more difficult to digest than vegetable proteins. Ground-breaking epidemiological research discussed in the book *The China Study* by T. Colin Campbell, professor of Nutritional Sciences at Cornell University, also links animal protein diets with disease. Conversely, plant-based proteins protect and enhance health.

Liver & Gut Detoxification

Poor diet and environmental pollution can cause malabsorption problems, build-up of toxins, and oxidized stress. If there is excessive free radical formation and accumulation of toxins, inflammation in cells and tissues usually occurs.



Since most people consume too many toxic foods (trans fats and simple sugars), the stage is set for significant cellular dysfunction and a real need for cellular detoxification.

The body's natural detoxification process removes toxic substances, including foreign chemicals, free radicals, and oxidized fats and proteins. Detoxification is one of the major functions of the liver and lower gastrointestinal tract.

However, most people need additional nutritional support to aid the liver and gastrointestinal system in removing excessive toxic compounds accumulating in the body. This is particularly true if the digestive system is not functioning optimally.

Gastro-protective and digestive agents can restore the balance in the gastrointestinal system, thus aiding the absorption of nutrients and reducing the build-up of damaging toxins and oxidized molecules.

Boosting Glutathione – The Master Antioxidant & Detoxifier

Glutathione is the most powerful antioxidant produced in the body and is vital for immune system function as well as detoxification. Glutathione is synthesized in the liver from the amino acids cysteine, glutamic acid, and glycine.

Exposure to dietary and environmental toxins and damage from oxidative and inflammatory stress all create special demand for cellular glutathione.

Glutathione Boosters

- Glycine
- Glutamine
- N-Acetyl Cysteine
- Turmeric
- Milk Thistle
- Selenium

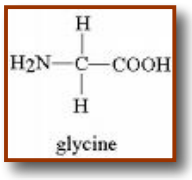
In cells, glutathione inhibits the formation of free radicals and protects against these damaging free radicals. As a detoxifier of heavy metals and drugs, glutathione is also crucial to liver health.

However, most experts believe the body does not convert oral glutathione supplements into glutathione inside cells. Instead, the body must produce glutathione naturally, and that process is limited by the levels of necessary precursors to glutathione available in the body.

Higher blood levels of glutathione are associated with better health, especially in elderly people. Supplemental compounds can boost glutathione levels, including the amino acids glycine and glutamine. N-acetyl-cysteine (NAC) is derived from cysteine and is quickly

converted to glutathione once it enters the body. Many studies have proven NAC boosts intracellular glutathione levels. Additionally, curcumin (curry spice), milk thistle (known for liver protection), and selenium are also considered glutathione boosters.

L-Glycine



Glycine is one of the three amino acids that form glutathione.[3] In addition to enabling glutathione production, glycine directly nourishes key detoxification organs, like the liver, kidneys, and intestines.[4]

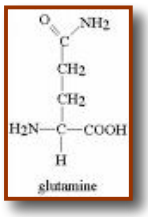
Glycine is essential not only for elimination, but also for a normally-functioning digestive system. It supports healthy gastric secretions (regulating bile acid synthesis used to digest fats) and also reinforces healthy gastric mucosa. Glycine is further required for the metabolism of proteins, amino acids, hemoglobin, and glucose. It is found abundantly in prostatic fluid and is used to construct normal DNA and RNA strands, the genetic material needed for proper cellular function and formation.[5]

Glycine is necessary for central nervous system function, may improve memory and other cognitive functions,[6] and converts to the neurotransmitter serine, which helps the body synthesize cysteine, the precursor to glutathione.

Glycine is perhaps best known for its role in helping create muscle tissue and preventing the breakdown of muscle (by boosting body levels of creatine).[7] In this way glycine enhances energy use, increases endurance, and aids in essential muscle tissue repair.

[3] J. Current Opinion Clinical Nutrition Metab Care 2003;6:229.
[4] Alcohol Clin Exp Res. 2005 Nov;29(11 Suppl):162S-5S.
[5] J Pediatr 1996;129:449-52.
[6] J Clin Psychopharmacol. 1999;19:506-12.
[7] J Pediatr 1996;129:449-52.

L-Glutamine



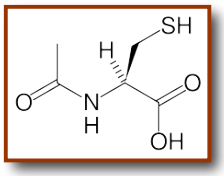
Glutamine is involved in more metabolic processes than any other amino acid, and is used by nearly every cell in the body.[8]

Glutamine is one of the amino acids that helps form the antioxidant glutathione and works to remove toxins from the body. It is essential for protecting the liver and maintaining intestinal function, cellular hydration, and protein metabolism.[9]

Glutamine is the primary source of energy for the various cells of the immune system, including T cells and macrophages. Under stress, the body's need for glutamine outpaces the body's ability to synthesize it. Without sufficient glutamine, the immune system cells become malnourished.

Glutamine plays a major role in protecting the integrity of the gastrointestinal tract by increasing mucosal and villi (tiny, finger-like projections) health in the intestine. It also helps maintain normal blood sugar by converting to glucose when more energy is needed, and particularly serves as a source of fuel for cells lining the intestines.

N-Acetyl-Cysteine



N-acetyl-Cysteine (NAC) is a derivative of the amino acid L-cysteine, a major precursor in the formation of the antioxidant glutathione.[10] NAC is more stable than L-cysteine and is quickly metabolized into glutathione once it enters the body.

NAC is a potent cell detoxifier, and it also helps to strengthen cell membranes. NAC strengthens the protective lining of the stomach and intestines, and has proven liver-protecting qualities.

Milk Thistle (standardized to 80% silymarin)

The active component of milk thistle is silymarin, a unique type of flavonoid with antioxidant ability. Silymarin has a stimulatory effect on key cells of the immune system,[11] and offers substantial protection for cell membranes against oxidative stress from environmental contaminants.

Silymarin has been shown to protect the liver from a variety of harmful substances and free radical damage. It prevents toxins from penetrating the interior of liver cells, while promoting the growth of healthy new cells.[12],[13]

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[8] Minerva Gastroenterol Dietol 1996 Mar;42(1):17-26.
[9] Wien Klin Wochenschr. 1996;108(21):669-76.
[10] J. Skin and Allergy News. August 2006, page 36.
[11] J Cancer Res Clin Oncol. Epub 2007 Apr 14.
[12] Eur J Pharmacol. 2007 Apr 10;560(2-3):110-6. Epub 2007 Jan 19.
[13] J. Molecular Carcinogenesis. 1999;26:321.

Fiber to Support Healthy Detox & Probiotic Colonies

Dietary fibers are the indigestible portion of plant foods that sweep through the digestive system, keeping the gastrointestinal tract clean and free of toxins and pathogens.

Soluble fibers undergo metabolic processing via fermentation in the large intestine and colon, and serve a prebiotic function that encourages growth and activity of beneficial gut flora, or probiotics, bifidobacteria and lactobacilli.[14] Metabolism of soluble fibers by bacteria in the colon yields short-chain fatty acids, which increase absorption of minerals[15] and protect the mucosal lining of the intestine.

Because soluble fiber takes longer to digest, it helps regulate blood sugar levels. Short-chain fatty acids from soluble fibers also help regulate blood glucose levels by acting on pancreatic insulin release and liver control of glycogen breakdown.

Insoluble fibers also shorten transit time through the intestinal tract and support elimination of toxins and cholesterol-producing substances from the body.[16]

Guar Gum

Guar gum is a soluble fiber from the seeds of the guar plant and is used both to increase satiety and support bulk in stools, easing and promoting regular elimination.

Guar gum is able to absorb toxic substances, like unhealthy bacteria, to support intestinal health. Animal studies have shown guar gum to improve calcium absorption in the small intestine and improve dietary glucose tolerance. As a fiber, guar gum also offers low allergy potential.

Combination of Apple Pectin, Apple Fiber & FiberSol®

Pectins, a soluble fiber, are polysaccharides found in the cell walls of plants. Extracts of fruit pectins are typically associated with the making of jams and jellies. In the large intestine and colon, microorganisms digest pectin and liberate short-chain fatty acids that support intestinal health.

Pectin delays stomach emptying, thereby helping prevent blood sugar swings, and is associated with healthy cholesterol levels by increasing viscosity of the intestinal tract, leading to reduced absorption of cholesterol from bile or food.

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[14] Am J Clin Nutr 2005;82 (2): 471-6.
[15] J Nutr . 2003;133 (1): 1-4.
[16] J Nutr. 1994; 124:78-83.

Pectins are also considered important in supporting the excretion of heavy metals and endocrine-disrupting chemicals from the body.

Apple fruit fiber is a mostly insoluble fiber that adds bulk and softens stools, and is good for people who are sensitive to wheat and oat bran. Apple fiber, which does include some apple pectin, also helps rid the body of heavy metals, promotes regularity, and tones the gastrointestinal tract.

Inulin is an insoluble fiber found in many fruits and vegetables (artichokes, bananas, chicory roots, etc.) and is used to support heart health and healthy cholesterol levels. It is also a potent food for probiotics in the intestine and may help with absorption of calcium and magnesium.

Slippery Elm Extract (4:1 concentration)

Slippery elm bark is a kind of fiber that is rich in calcium and bioflavonoids. It is typically used to soothe mucous membranes of the bowels, stomach and urinary tract.[17]

Additionally, slippery elm is used to draw out and assist the body in expelling toxins.

Slippery elm is also considered valuable in supporting the body's adrenal glands and upper respiratory system.

Nutrients for Healthy Joints, Skin, Eyes & Heart

Healthy joints require rebuilding over time to prevent normal wear and tear from degrading cartilage that supports joints as well as to promote collagen that cushions impact for joint movements.

GreenGrown® Glucosamine - (a vegetarian form of Glucosamine)

GreenGrown glucosamine is not derived from shellfish (as is most glucosamine) but instead comes from a non-GMO, entirely vegetarian process of corn fermentation. Well studied as a joint renewal nutrient, glucosamine supports the flexibility and comfort of the body's tendons, ligaments, cartilage, synovial fluid, mucus membranes, and even promotes healthy structures in the eye, blood vessels, heart valves, and soft tissues.

Studies show that glucosamine contributes to the expansion and maintenance of healthy joint space, and in 6 double-blind, placebo-controlled trials, positive results emerged for hip and knee health (about 40% improvement compared with placebo). Glucosamine

[17] J. Alimentary Pharmacology Therapy 2002:16:197.

also inhibits certain enzymes that destroy cartilage, including collagenase and phospholipase.

MSM (Methylsulfonylmethane)

Methylsulfonylmethane or MSM is an organic sulfur-containing compound that readily crosses the blood-brain barrier, which makes it highly available to the body. MSM is used to support healthy muscles, joints18, teeth, skin, and soft tissue. Because MSM is found in the body's tissues and fluids, and helps to maintain collagen, which is important for cellular tissues and bones. MSM helps maintain healthy collagen by bonding it together, thus aiding in the formation of flexible bonds between cells.

Since collagen also holds skin tissue together, MSM helps support skin and wound healing. If MSM supplies are depleted, dry, cracked, damaged, and wrinkled skin may result! Hair and nail growth may thus also be improved by supplemental MSM.
MSM is thought to support joint comfort by relieving pressure from toxins at the cellular level—by allowing toxins to go out and nutrients to come in—thereby improving circulation. MSM can help flush lactic acid and metabolic toxins created from overexertion out of cellular tissues in joints.

Studies show that combining glucosamine with MSM creates faster and more dramatic benefits for joint comfort than either nutrient alone.

MSM has been found to increase the availability of vitamin C and other antioxidant nutrients, which support immune function.

Turmeric (curcuma longa)

Curcuminoids are also associated with inhibiting eicosanoids, which are involved with the body's inflammation process. Turmeric is used widely in India and Indonesia to promote joint and tissue comfort and as an aid in digestion.

The bright orange curcuminoids contained in turmeric are powerful bioflavonoids. They have a wide range of antioxidant activities and have been shown to increase glutathione in the body, thus making them valuable in detoxification as well as immune function.[19]

Curcumin has been shown in clinical studies to provide significant soothing effects in the stomach and small intestine. It has also demonstrated protective activity in the stomach and colon.[20]

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[18] BMC Complement Altern Med. 2011 Jun 27;11:50
[19] J. Skin and Allergy News, May 2005, page 20.
[20] Biosci Biotechnol Biochem. 2000; 64:503-509.

Vitamin C (calcium ascorbate and ascorbic acid)

Vitamin C may be the most important water-soluble antioxidant in the body. It protects the body during times of stress and aids in the absorption of other nutrients. It is also essential to maintaining normal immune function.[21],[22]

Vitamin C works synergistically with lysine and proline to synthesize collagen and elastin, which support smooth arteries, skin, muscles, and connective tissus. It also plays critical roles in protecting the eyes, kidneys, and nerves. Vitamin C has detoxified histamine in test tubes, which is a product of stress and immune system insult.

Vitamin C protects cells, plasma lipids, DNA, proteins and even other antioxidants from oxidative damage (e.g., it reduces oxidized vitamin E in cell membranes).[23] Vitamin C also increases the synthesis of natural antiviral and antibody substances produced by the body, and it stimulates the activity of other key immune cells.

Taurine

Perhaps best known for eye health, taurine helps rebuild retinal function and visual acuity but it is also a vital nutrient for improving heart health and artery elasticity.[24]

Taurine is an overlooked nutrient, with its exceptional ability to help detoxify the liver (after alcoholic intake), remove lactic acid from muscles (and restore easy movements), support brain function and immune system regulation,[25] and also to support general cellular energy.

Taurine has also been studied for its role in reversing hearing loss and ringing in the ears, and is believed to support healthy insulin sensitivity as well. Taurine is present in many tissues in the body at higher concentrations than any of the other amino acids, which explains its role in protecting against disease.

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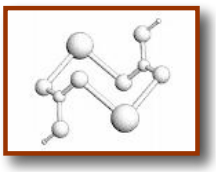
[21] Psychopharmacology. 2002;37:261-7.
[22] Int J Sports Med. 1996 Jul;17(5):379-83
[23] Free Radic Biol Med. 1999 Nov; 27(9-10):1064-79.
[24] Nutr Rev 1975;33:343-7
[25] Curr Opin.Clin Nutr Metab Care 2006;9(6):728-733

Nutrients for Healthy Bones

Many people know about calcium and sometimes about magnesium for bone density, but it takes a combination of calcium, magnesium, vitamin D3, boron, and vitamin

Calcium (from carbonate, ascorbate, d-glucarate & dicalcium phosphate)



Calcium, the most abundant mineral in the human body (1-2% body weight with more than 99% in the bones and teeth), is crucial to building and maintaining strong bones, teeth, and connective tissue. Calcium helps the muscles contract as necessary for motion (in contrast with magnesium, which helps muscles relax).

Calcium absorption from the small intestine and its excretion from the kidneys are carefully regulated to ensure precise concentrations of calcium in the blood plasma. High or low calcium levels can both cause problems in the body.

Calcium also promotes healthy digestion through the production of hormones and enzymes. Calcium increases fat breakdown, and also discourages the accumulation of excess dietary fat within the digestive tract,[26],[27] thus protecting the colon from oxidative damage.[28]

Magnesium (as citrate)

Magnesium is required by more than 300 enzymatic, cellular, nerve, and hormonal energy processes in the body, including the support of bone density (50-65% of magnesium is stored in bones).

Magnesium is considered the mineral that "relaxes" the muscles (in contrast with calcium, which helps muscles "contract" as needed), so skeletal magnesium stores get depleted during times of stress and, over time, lead to deficiencies and weakened bones.

Magnesium is also critical in overall energy metabolism and glucose utilization.[29] Magnesium is involved in activating amino acids for use by cells and in the synthesis and breakdown of DNA. It also plays a significant role in the metabolism of other minerals,[30] and is important in maintaining intracellular electrolyte balance. It also facilitates neurotransmission, nervous system, and heart health.

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[26] Int J Obes 2005;29:292-301.
[27] J Clin Nutr 2003;77:281-7.
[28] N Engl J Med 1999;340:101-7.
[29] Diabetologia. 1990, 33/9 (511-514)
[30] Clin Calcium. 2004 Dec;14(12):96-9

High-fat diets may interfere with magnesium absorption. Excess fats that cannot be absorbed in the small intestine remain in the gut and bind with magnesium to form insoluble soaps. These soaps cannot pass through the intestinal wall and are excreted (along with valuable magnesium stores).

Vitamin D3 (as cholecalciferol)

Vitamin D is a fat-soluble vitamin required for absorption of nutrients in the intestinal tract. Vitamin D3 is necessary for growth, maintains healthy bone density, and protects against muscle weakness. Vitamin D3 is necessary to absorb calcium in the intestines but also to help usher calcium deposits into bones and not into soft tissues.

Recent research indicates a true need for increasing the daily requirement for Vitamin D from 400 IU daily to 1000-2000 IU daily, since blood serum levels typically show critically low vitamin D levels. Increasingly, consumers are becoming aware that vitamin D3 or cholecalciferol is the preferred and more bioavailable form (vitamin D3 is up to ten times more potent than D2 or ergocalciferol).

The active form of vitamin D is actually a steroid hormone found to enhance how immune cells communicate. Vitamin D has extensive immune-enhancing, antioxidant, and cell-protecting activities that are yet to be fully understood.[31]

Potassium (as chloride)

Potassium is an essential macro-mineral and electrolyte vital to keeping cells alive. It aids in the production of cellular energy, and is key to maintaining fluid and electrolyte balance in the body.[32] It also regulates the transfer of nutrients through cell membranes. Potassium is antagonistic with sodium, which means an imbalance in one creates an imbalance in the other, and normally, potassium should predominate in cells.

Potassium is important to vascular health, normal muscle contractions, kidney function, and stomach secretions. It is essential to healthy nerve transmission.

It is also thought to alleviate allergic responses, promote healing, and address fatigue.

Boron (as citrate)

Boron contributes to the efficiency and absorption of other vital nutrients, including calcium, magnesium, vitamin D, potassium, and phosphorus.[33] Boron deficiencies lead to urinary loss of calcium and magnesium as well as hormones involved in healthy bone formation.

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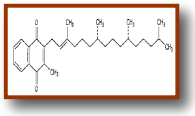
[31] Nutr Res. 2000; 20:91-102.

[32] Nutr Rev (USA) Nov 1994, 52 (11) p367-75

[33] Environ Health Perspect 1994;102(suppl 7):59-63;79-82.

Heightened boron levels support stronger bones and healthy hormones (some studies have shown boron as promoting healthy sexual function as well). Boron is also known for boosting brain activity, and is considered important for immune function and energy use in the body.

Vitamin K2 (as Menaquinone-7)



Vitamin K2 is crucial in the absorption of important nutrients, in particular calcium, which can otherwise be deposited in soft tissues rather than bones.[34]

Vitamin K2 is also important for helping maintain smooth, well-functioning arteries that do not have sand-like deposits of calcium that belong in bones.

Vital Antioxidants & Phytonutrients

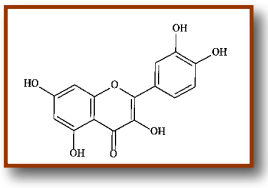
All life requires oxygen to exist. Oxygen is also a highly reactive molecule. Free radicals are reactive electrons produced by normal oxidation processes. Oxidative stress on cells occurs when there is an imbalance between production of reactive oxygen species free radicals and the body's ability to detoxify it.

Under healthy conditions, balance is preserved by enzymes that provide constant inputs of metabolic energy and antioxidants that reduce and repair cell damage caused by free radicals. If there is excessive free radical formation, and the body's network of antioxidants is depleted, metabolic oxidation processes become imbalanced and toxic.

The presence of dangerous amounts of free radicals can alter the way in which cells code genetic material. They cause toxic effects that damage all components of the cell, including mitochondria. If the mitochondrion suffers too much damage, the cell will die.

Phytonutrients are extremely beneficial plant-derived food compounds. In contrast with nutrients, they are not required for normal metabolic function. Still, they are potent antioxidants that reduce, neutralize, and prevent damage to cells from free radicals.

Quercetin



Quercetin is one of the most potent bioflavonoids used by plants to protect against UV radiation and microbes. It is the most active of the flavonoids. Quercetin has powerful cell protecting properties[35] and stabilizes cell membranes so they are less reactive to allergens and toxins by inhibiting the manufacture and release of histamine. Bioflavonoids are, in fact, considered "nature's biological response modifiers."

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[34] Calcif Tissue Int 1996;59:352-6 and J Bone Miner Res 2000;15:515-21

[35] Clin Cancer Res. 1996; 2:659-668.

While bioflavonoids, like quercetin, are poorly absorbed by the body, they stimulate the body to produce uric acid to excrete them, which helps the body eliminate other unwanted compounds.

Quercetin inhibits lipid peroxidation and increases protective mucus production in the gastrointestinal tract.[36] Quercetin is also thought to help preserve vitamin C in the body and support the health of fragile capillaries.

Grape Seed Extract (4:1 Concentration)

The main active components of grape seed extract are oligomeric proanthocyanidins (OPCs), another potent bioflavonoid. OPCs are water soluble, highly bioavailable, and have uniquely powerful antioxidant capabilities.[37] For example, they are able to cross the challenging blood-brain barrier and provide antioxidant protection to both the brain and the central nervous system.

OPCs maintain cell integrity, enhance the growth and viability of normal cells,[38] promote vascular health, and protect the liver and other organs from toxicity.[39]

Grape seed extract has been shown to have a positive effect on how we metabolize food.[40] It can also help support the body in maintaining balanced blood sugar[41] and healthy cholesterol levels.

Ginger Root (root powder)

Ginger is used in folk medicine throughout the world to aid in digestion and is thought to fight unfriendly intestinal bacteria without impairing friendly bacteria. Gingerols are associated with inhibiting prostaglandin and leukotrine formation, which influence blood flow and inflammation.

Ginger has gastro-protective qualities[42] and is a digestive stimulant. It has been shown to have a positive influence on the activity of digestive enzymes[43] and promote production of saliva, digestive juices, and bile. Ginger enhances blood circulation and is considered supportive of healthy cholesterol levels.

Vitamin A (100% natural beta-carotene)

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[36] Z Naturforsch[C]. 1998; 53:82-88.
[37] J Clin Pharm Ther. 1998 Oct;23(5):385-9.
[38] Carcinogenisis. 1999 Sep;20(9):1737-45.
[39] Ann N Y Acad Sci. 2002 May;957:260-70.
[40] J. Skin and Allergy News June 2006, page 24,)
[41] J. Nature. 2006;444:1009.
[42] Am J Chin Med. 1989;17(1-2):51-6.
[43] Nahrung. 2003 Dec;47(6):408-12

Vitamin A is a fat-soluble antioxidant essential for overall health. Beta-carotene is one of the most important carotenoids in nature, and it is more efficiently converted by the liver into vitamin A (retinol) compared to other carotenoids.

Beta-carotene enhances intercellular communication and normal cell division, while promoting vision, eye, skin, and mucous membrane health. It also enhances the immune response against environmental toxins and protects cells from damage caused by damaging free radicals.[44]

The evidence is overwhelming that a diet rich in beta-carotene may reduce the risk of certain types of cancer.[45]

Vitamin E (as mixed tocopherols and tocotrienols)

Vitamin E is a potent lipid-soluble dietary antioxidant with immune enhancing properties.[46]

Vitamin E (alpha-tocopherol) protects cell membranes from deterioration by free radicals.[47] In particular, it has been shown to decrease oxidative stress on lipid cells[48] and improve glucose disposal.[49] This leads to improved oxygen utilization and balanced blood sugar, while promoting cardiovascular health.[50]

Effective absorption of vitamin E by the gastrointestinal tract is critical to central nervous system health and coordination.

Selenium (as selenomethionine)

Selenium is a vital antioxidant that protects the body from free radical damage in many ways and speeds up the metabolism of fatty acids.

It is incorporated into proteins to make selenoproteins, important antioxidant enzymes that protect cells from cellular damage.[51] One selenoprotein is also the body's most powerful antioxidant, glutathione. Without selenium, the body cannot produce glutathione.

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[44] J Infect Dis. 2006 Nov 1;194(9):1217-25
[45] J Natl Cancer Institute. 1999; 91:547-56
[46] JAMA. 1997; 277:1380-1386.
[47] FASEB J. 1999; 13:1145-1155.
[48] Annu Rev Nutr 2005;25:151-74.
[49] J Investig Med. 2004 Jan;52(1):24-32.
[50] Diabetes Res Clin Pract. 1999; 45:169-182.
[51] J Nutr. 2000;130:1653

Another crucial selenoprotein is thioredoxin reductase, which maintains the antioxidant function of vitamin C (ascorbic acid) by catalyzing its regeneration from its oxidized form.[52] Selenium also acts synergistically with vitamin E, each improving the efficiency of the other. They work together to aid in the production of antibodies and to help maintain a healthy heart and liver. The FDA supports limited claims for selenium as protection against cancer.

Zinc (as methionate)

Zinc is an essential nutrient needed to maintain the integrity of cell membranes. It has potent antioxidant properties and is required for a number of immune functions, including boosting of thymus gland function. Zinc increases the absorption of vitamin A and is needed to maintain the proper concentration of vitamin E in the blood.

Zinc also functions as a catalyst for many essential enzymes. This includes the antioxidant enzyme super-oxide dismutase (SOD), which supports cellular health by protecting cytoplasm and mitochondria from the body's most common and aggressive free radical, super-oxide.[53]

[52] Biochem J. 2000 Feb 15;346 Pt 1:1-8.
[53] J Toxicol Clin Toxicol. 1999;37:279-92.

Cellular Energy & Renewal Nutrients

Cells need nutrients to create energy. Dysfunction of nutrient processing leads to a "metabolic syndrome" with breakdown in cellular communication and diminished energy production. Without adequate cellular communication, hormones, neurotransmitters and enzymes cannot organize body functions or cell metabolism properly.

B Vitamins

B vitamins are essential for cell metabolism, and they support the body's enzymes in energy production.

B vitamins help maintain a healthy gastrointestinal tract, playing important roles in the metabolism of carbohydrates and fats into energy. They also combat the symptoms and causes of stress, which deplete our energy stores.

B vitamins are water-soluble and must be replenished daily. Ideally, B vitamins should be taken together in a complex.

Vitamin B1 (thiamine)

Thiamine, or B1, plays a key role in intracellular glucose metabolism.[54] The body cannot effectively convert carbohydrates into energy without it.[55] Thiamine is also involved in the metabolism of branched-chain amino acids (proteins), and is important to the growth and protection of cells.[56]

Thiamine is crucial to normal neural activity and has positive effects on the health of intestinal muscles and mucous membranes. It also aids proper digestion by contributing to the production of hydrochloric acid.

Vitamin B2 (riboflavin)

The body requires riboflavin, or vitamin B2, to ensure cells can reproduce correctly and supply the body with fuel. Riboflavin acts as an important facilitator and protector for a number of other nutrients and enzymes, without which the body could not convert fats, carbohydrates, and proteins into cellular energy.

Riboflavin also acts as a precursor and cofactor with other antioxidants in the production of glutathione.[57] In this way, it protects cells from mitochondrial damage[58] and helps

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[54] Diabetologia. 1996; 39:1263-1268.
[55] Mayo Clin Proc. 1999; 74:259-263.
[56] Ann Vasc Surg. 2000; 14:37-43.
[57] Nutr Rev. 1998; 51:149-150.

regenerate vitamin E in the body. Along with vitamin A, riboflavin supports healthy mucous membranes in the digestive system.

Vitamin B3 (niacin)

Niacin, or vitamin B3, combines with other B vitamins to release energy from carbohydrates to the cells and regulate glucose in the body. Niacin is also indispensable to fat and protein metabolism. It is perhaps best known for its role in inhibiting cholesterol synthesis and promoting heart health.

Niacin also aids in the production of hydrochloric acid and other digestive juices, and is required for the metabolism of fats.[59]

Vitamin B5 (pantothenic acid)

Pantothenic acid, or B5, is involved in an array of biological functions related to the production of energy, and is necessary for normal functioning of the gastrointestinal tract.

Pantothenic acid is an essential precursor of coenzyme A, a vital body chemical involved in many necessary metabolic functions, including the production of glucose from amino acids.[60] It also contributes to the formation of acetylcholine in the intestines, which enhances peristalsis (rhythmic intestinal motion) and facilitates healthy elimination.

Pantothenic acid is also is needed to make adrenal hormones and in the production of neurotransmitters, and works to protect the nervous system from stress.

Vitamin B6 (as pyridoxine)

Lack of vitamin B6 is associated with higher inflammation levels. Healthy levels of B6 combine with folic acid and B12 to normalize homocysteine metabolism and maintain cardiovascular and circulatory health.[61]

High-dose Vitamin B6 has been correlated with joint comfort support as well as healthy neurotransmitter production and healthy hormones and moods. Optimal levels of riboflavin (B2), vitamin C, magnesium, and selenium improve B6 absorption.

Vitamin B6 is also necessary for the production of hydrochloric acid (necessary for digestion), normal red blood cells (to transport oxygen to the cells and carbon dioxide waste back to the lungs for excretion), and the absorption of fats and proteins.

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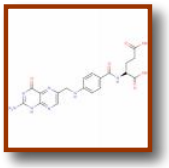
[58] AIDS Rev. 2003 Jan-Mar;5(1):36-43.
[59] Atherosclerosis. 2007 Jun;192(2):432-7. Epub 2007 Jan 19
[60] Free Rad Biol Med. 1996; 20:793-800.
[61] J Vasc Surg. 1994 Dec;20(6):933-40.

Vitamin B6 is needed for the synthesis of the nucleic acids RNA and DNA, which are necessary for normal cellular growth, and aids in the absorption of iron, vitamin B12, and a host of other nutrients.[62] B6 is also required by the nervous system for the synthesis of mood-regulating neurotransmitters, such as serotonin.

Folate



Folate is another one of the B vitamins needed for healthy homocysteine regulation to support a healthy heart. Folate is also needed for protein metabolism and energy production,[63] and is crucial to the good health of every cell in the body.[64] Folate functions as an active coenzyme in DNA and RNA synthesis, and is needed to regulate cell formation and maintain cell integrity.[65]

Vitamin B12 (methylcobalamin)

Vitamin B12 is required for proper digestion, absorption of nutrients, synthesis of proteins, and metabolism of carbohydrates and fats.[66] It also works with folate and vitamin B6 (pyridoxine) to protect the heart by removing excess homocysteine from the blood.

The methylcobalamin form of B12 is a preferred cofactor in the creation of methionine, a precursor of S-adenosylmethionine (SAMe). SAMe is involved in the synthesis of myelin and important neurotransmitters. Myelin is a protective layer that coats nerve cells and aids in cellular communication.

Biotin

Biotin, or vitamin B7, is essential to cell growth. It is necessary to the production of essential fatty acids and the conversion of carbohydrates and fats into energy.

Biotin stimulates enzymes that regulate healthy carbohydrate metabolism in the liver, and enhances glucose uptake in muscle cells[67] to maintain steady blood sugar levels.[68]

Chromium (as picolinate)

Chromium is vital to the synthesis of cholesterol, fats, and protein, and it is needed for energy production. It is particularly important in the metabolism of glucose,[69] and proper

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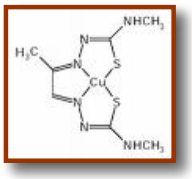
[62] Nippon Jinzo Gakkai Shi. 1993 Aug;35(8):975-80.
[63] La Revue du praticien 43 (11): 1358-63.
[64] Semin onco. (5 Suppl 18): S18-30-S18-39.
[65] Gastroenterology (USA), 1997, 112/1 (29-32).
[66] Baillieres Clin Haematol 8: 441-459.
[67] Nippon Rinsho. 1999;57:2261-2269.
[68] U.S. Pharmacist (Nov 2006). 31 (11).

insulin utilization.[70] Some claim chromium may increase lean body mass by boosting protein metabolism.

Copper (as gluconate)



Copper is found primarily in the bloodstream as a cofactor in various enzymes, energy production, insulin function, and the breakdown of fats. The body has to have both copper and zinc to produce the powerful antioxidant Superoxide Dismutase (SOD).[71]

Copper protects the heart, bones, and joints by keeping collagen and elastin fibers healthy. Copper also helps supply the heart with healthy, oxygenated blood, protects nerve fibers, and aids in nerve signal transmission in the brain.

Manganese (as gluconate)

Manganese is concentrated in the liver, brain, pancreas, and skeleton. It acts as a catalyst and cofactor in many enzymatic processes needed for protein and fat metabolism, and aids in the regulation of blood sugar and storage of glycogen in the liver.[72]

Manganese is an integral part of the antioxidant enzyme Superoxide Dismutase (SOD) and the synthesis of glycoproteins needed to protect mitochondria, the principal energy source for all cellular functions.

Manganese is needed for the utilization of vitamin B1 (thiamine) and vitamin E. It also works with B-complex vitamins to protect the body from stress.

SOD *Boosters*

- Copper
- Manganese
- Zinc
- Vitamin C

Molybdenum (as sodium molybdate)

Molybdenum is a trace mineral found in all tissues of the body, particularly in the bones, teeth, kidney, and liver. It is important because it helps the body make several enzymes which aid in protein synthesis and promote normal cell function.

Vanadium (as vanadyl sulfate)

Vanadium is needed for cellular metabolism and is an essential component of many enzymes. It plays a role in growth and reproduction, and the formation of bones and

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[69] Metabolism. 1987 Apr;36(4):351-5

[70] Biol Trace Elem Res 2004;Summer;99(1-3):1-16.

[71] Metabolism. 1997;46:1380-3.

[72] Neurotoxicol. 1999; 20:213-223.

teeth. Vanadium also has a balancing effect on blood sugar levels and inhibits cholesterol synthesis.[73],[74]

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[73] Diabetics. 1996;45:659-66.
[74] J Clin Invest. 1995;95:2501-9.

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