Vitamins, Minerals & Supplements

Nutrient Sources, Functions, Symptoms of Deficiency & Toxicity, and more…

by Darlene Jorgens, HHP, CMH

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"Let food be thy medicine and medicine be thy food."

~ Hippocrates

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Introduction

The intent of this manual is to provide the student of natural health with a reference for the most commonly used vitamins, minerals, foods and supplements that are of benefit to clients. This is not a complete resource by any means (there are thousands of supplements) it is a place to begin.

The bio-individuality of every individual along with their nutritional status and health concerns must be considered prior to making supplement recommendations. For most supplements listed here, the most well-known contraindications have been shared. Still this information changes at times, therefore, it is the responsibility of the natural health professional to verify the safety and efficacy of all the supplements that they recommend. Simply said, not all foods and supplements are suitable at every stage of life and personal needs change over time.

Sourcing supplements can be a challenging. Very reputable companies with high standards sometimes make supplements that may not have the “best” ingredients. This makes it necessary to read the ingredients habitually. Just when you think you know what they are, there are certain vendors who will without notification change a formula, but not change the name of the product. This can have undesirable effects and while it may not necessarily make the product dangerous, it may make it less effective.

“Best practice” in this instance would be to change the formula then rename the new product and assign a new item number while simultaneously discontinuing the old formula (and old item number). Most companies do this, but we need to be ahead of ‘our game’. So be encouraged to take it upon yourself and be that ‘stickler for details’ because they are important and your clients are relying upon you.

Getting to know your professional supplement companies and their product line is important. At Genesis School of Natural Health, we encourage all eligible students to set up “student accounts” with our recommended vendors and begin using these products on yourselves as need arises. As professionals, our personal experience with these products, whether they be herbs, vitamins, foods or anything else speaks volumes. Once you graduate, be sure to contact these companies (most will want an emailed copy of your diploma and the employer identification number [EIN] for your business) to be set up with a practitioner account.

By using your student account, you begin learning about and experiencing products and formulas first hand during your studies instead of waiting until graduation. The supplement industry is very competitive and generally their customer service is very good. The larger companies have customer reps, but all venders are available to answer questions regarding their products and recommended protocols. Most provide learning opportunities, some are free, and some are not. There are usually a lot of instructional videos and materials available on their websites.

Should there be a conference you would like to attend through a specific vendor, don’t be afraid to reach out to your customer rep and enquire after a discount on the workshop fee. While you may still have to pay for travel, hotel, and food, vendors generally expect to waive the registration fees for a certain number of attendees. It never hurts to ask.

The vendors that we recommend are not the only reputable vendors available, but they are a great place to start. Becoming an “expert” in your professional product line is just as important as the many hours of study that you apply to learning about anatomy, principles of health, and disease states.

Lastly, there is a question that weighs on my heart that I would like to leave with you before you delve into the material. Please open your heart to this challenge. Perhaps on occasion each of us would be reminded to consider the following:

Is it possible that after learning so much, that we could become mere reductionistic "PEZ"-dispensers of herbs and remedies, merely treating symptoms and disease states, perhaps not with 'drugs' but instead with herbs and supplements?

For we know that the body is designed to heal itself and that our 'job' is to thoughtfully support the processes without risk of a greater imbalance of the whole. Most clients come for "natural" help 'steeped' in the Western mindset with limited understanding of what holistic health truly entails. This creates a perception of alternative remedies similar to prescription drugs (only 'natural'). Sadly, they lack the basic understanding of just how their toxic their environment, food, water, relationships, habits, emotions, inner thoughts, and spirituality us and how it undermines their body's ability to thrive. So the natural health professional teaches… so that they may "recover themselves" and regain their health without further harm to their person.

Although we will get into the nitty gritty of supplements shortly, keep in mind that sometimes what people need most is not a supplement. Rather, their need of any number of things might be even more important at that moment in time. Perhaps what is required is a technique to de-stress, or encouragement to make a healthy choice in lifestyle or boundary-setting in a negative relationship, or maybe a listening ear, or a word spoken in truth yet covered with compassion, or any number of things…

Not one of us that can be everything to every person. There is just too much sickness, pain, and suffering in this world. Sadly, there is a glaring lack of true 'healers', and this is where you and I come in. To make a difference it will take each one of us and all those who are willing to join our ranks. So please, guard against getting sucked into tunnel-vision, for the need is too great. Together, let us expand our vision and build our networks. Students (and graduates) are encouraged to fully use the tools provided here at Genesis (such as the Student Discussion Group) and to make relationships with other students. One day soon, you just might get to lean on each other.

So, may we be granted the wisdom and the ability to convey what is most important to those we are called to serve. I am grateful that you are here. ~ Darlene

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Part One… VITAMINS

A vitamin is an organic compound necessary for the normal metabolism, growth, and vitality of a living organism. Vitamins, or "co-enzymes" as they are sometimes called, are critical cofactors that help to create enzymatic reactions in the body that break down proteins and build up tissues in the body.

"Every vitamin is a biological mechanism, not a chemical."
~ Dr. Royal Lee

The four fat-soluble vitamins are A, D, E, and K. Fat-soluble means they can be dissolved in fats, then enter the bloodstream through the small intestine. From here fat-soluble nutrients circulate throughout the body until they are used or stored, primarily in the liver and fatty tissues.

Some vitamins such as D-3 and B-3 can be synthesized by the human body, while others must be obtained via the diet through the consumption of plants and animals. Although most animals are able to produce their own vitamin C; humans, monkeys, guinea pigs, and certain birds and fish must acquire it from their diet as they are incapable of synthesizing it.

Healthy fats are integral to the proper absorption of vitamins into the body, therefore, eating "fat free" can actually lead to nutrient deficiencies. To increase the absorption of fat-soluble supplements it is beneficial to take them with a meal that has at least three teaspoons of other oils or fats.

The remaining vitamins are water-soluble as they dissolve in water. They already come packed in water from food sources or quickly dissolve in water as a supplement. It is not necessary for the remaining water-soluble vitamins (and minerals) to go through the acidic digestive process in the stomach. Most water-soluble vitamin particles are small enough to be absorbed directly after transport to the small intestine easily pass into the bloodstream for delivery.

Most, water-soluble nutrients taken in excess, are not stored in the body long-term but excreted in the urine. They need to be replaced frequently. Most B vitamins need to be replaced daily. However, adequate stores of vitamin C and folate can last a long few days before being completely depleted, while water-soluble B-12 can be stored in a healthy liver for a much longer period of time.

"Vitamins should come from foods."
~ Dr. Royal Lee

Vitamins should not be thought of as simply "chemicals", rather they are biological mechanisms that do not work independently, rather they work interactively. In nature, vitamins are always present in complexes with other vitamins and nutrients. They are never broken down into individual components prior to consumption as is the case with synthetic, lab-created "isolated" supplements.

Vitamin A/Beta-carotene (Retinol)

Function
Vitamin A, an antioxidant, is both fat soluble (fish oil) and water-dispersible (Beta-carotene). Carotenoids in oil are more easily absorbed than those in water or food. It is synthesized from Beta-carotene in the healthy walls of the digestive tract and stored in the liver. Beta-carotene is converted to shorter in length isomers during cooking which are more bio-available.

Vitamin A is responsible for the health of the skin, hair, nails, eyes, lungs and mouth, all the membranes in the digestive tract, genital organs and membrane lubrication, and anti-aging tissue formation. It builds resistance against respiratory disorders and nourishes the skin, hair, teeth, bones and gums. Vitamin A also protects against polluted air and other toxins, cancer formations, colds, flu, and infections. Another of its many benefits is that it increases the permeability of capillaries for tissue oxygenation.

Beta-carotene along with vitamin E minimizes the oxidation of LDL-cholesterol, lowering the risk of atherosclerosis and coronary heart disease. Combining beta carotene with vitamins E and C offers significant protection against ultraviolet radiation from the sun as well as chemotherapy.

May Require Supplementation
Please note that while most people can obtain the vitamin A they need through diet, some are deficient because of malabsorption or as a result of being on very low-fat diets.

Symptoms of Nutrient Deficiency
- Can be asymptomatic
- Brittle Hair & Nails; Loss of Hearing or Taste
- Gastric Troubles, Weight Loss, Impaired Glucose Tolerance & Diabetes
- Repeated Sinus Infections
- Skin Issues: Scaly, Dry, Pigmentation Issues, Dandruff
- Kidney & Gallbladder Stone Formation
- Eyes: Dryness & Inflammation, Eyes “Glued” Shut Upon Waking, Difficulty Reading in Dim Light, Night Blindness, Blindness, Difficulty Identifying the Colors Blue & Yellow, Leading Cause of Preventable Night Blindness in Children
- Compromised Immune System, Inability to Fight Infections, Increased risk of Death from Malaria, Measles & Diarrhea
- Improper Tooth & Bone Formation

Food Sources
Vegetables-Dark Green: leafy greens, sweet potato leaves, spinach, chard, turnip greens
Vegetables-Orange: sweet potato tubers, carrots, pumpkins, squash
Fruit-Cantaloupe, mango, goji berries, butter, egg yolk, palm oil, and liver

Toxicity and/or Side Effects
There is less danger of an overdose with water-dispersible Vitamin A. “Signs of toxicity include: vomiting, joint pain, abdominal pain, bone abnormalities, dry/cracking skin, headache, gingivitis, irritability, fatigue. Symptoms disappear after supplementation is stopped.”[1]

Vitamin B-Complex

Thiamin, Riboflavin, Niacin, Pantothenic Acid, Pyridoxine, Cyanocobalamin, Biotin & Folic Acid

Function

Water-soluble B-complex vitamins can be thought of as the "stress and energy" vitamins. They are key in converting nutrients such as carbohydrates into glucose. A fuel which produces energy. In doing so, they support cellular metabolism.

B-complex vitamins also contain elements [Vitamins B-5 (Pantothenic Acid), B-6 (Pyridoxine), and B-12(Cobalamin)] which are specifically used by the brain to make neurotransmitters. Vitamin B-3 (Niacin) is important for nerve health, while Vitamin B-12 (Cobalamin) does its part to support the myelin sheath.

Our red blood cells (RBCs) are benefitted by B-complex as B-6 (Pyridoxine) and B-12 (Cobalamin) aid the body in producing heme, which is the metal or "iron" constituent of hemoglobin. While Vitamin B-1 (Thiamin) and Vitamin B-2 (Riboflavin) switch on enzymes found in the RBCs. Vitamin B-9 (Folate/Folic Acid) is important in proper development and size of the RBC.

Together, Vitamins B-6 (Pyridoxine), B-12 (Cobalamin) and Vitamin B-9 (Folate/Folic Acid) lower homocysteine in the bloodstream. While, Vitamin B-5 (Pantothenic Acid) benefits hormone regulation. In general, it is good to note that B-complex vitamins are crucial in preventing certain types of birth defects, cancer, and heart disease.

May Require Supplementation

Overconsumption of sugar and alcohol destroy B vitamins. Diabetics and alcoholics often need more B vitamins than most people. Birth control pills, antibiotics, seizure and acid suppressing medications, and steroid medications can lead to specific B-vitamin deficiencies. As does mental stress, febrile illnesses, and physical activity.

Symptoms of Nutrient Deficiency

- Fatigue, Anemia
- Gastrointestinal: Nausea, Vomiting, Diarrhea
- Muscle Weakness, Lack of Coordination, Muscle Wasting resulting in Pain/Soreness in Muscles or Joints
- Numbness or Tingling in the Fingers & Toes
- Skin: Dermatitis, Dry Skin, Cracks at the Corners of the Mouth, Frequent Bruising and/or Wounds requiring a long time to heal
- Confusion, Headache, Insomnia, Irritability
- Light sensitivity
- Neurological Birth Defects (Folate)
- Cancer
- Heart Disease

Toxicity and/or Side Effects

If B vitamins are not tolerated there is an underlying metabolism problem in the liver, potentially helped by a detox program. If synthetic B vitamins are used, some (not all) people may develop peripheral neuropathy. See each individual B vitamin listed for specific symptoms of toxicity.

Vitamin B-1 (Thiamin)

Function
A lack of Vitamin B-1 affects energy metabolism and tissue building throughout the body. Thiamin is anti-beriberi, anti-aging, aids digestion (especially protein), and is helpful in the production of hydrochloric acid in the stomach. It improves peristalsis, relieves constipation, prevents edema, supports the heart muscle, brain, and entire nervous system. It is also a catalyst in the cure for yeast and wheat allergies, and helps prevent cataracts. Those with diabetic kidney disease (nephropathy) had better kidney function when B-1 was supplemented. People with congestive heart failure on loop diuretics are susceptible to deficiency as are those suffering from Chronic Fatigue Syndrome.

In Southeast Asia, the removal of the bran from brown rice (making it white, quicker to cook, and more shelf-stable) eliminated Thiamine (and other B vitamins), causing Beriberi. Beriberi has a crippling effect it has on its victims ultimately leading to death. In the United States, white rice is required to be fortified with those B vitamins removed in the bran, but not with the magnesium. In the states, Beriberi often presents with chronic alcoholism, where it affects the central nervous system (brain and spinal cord). In response, the food industry began to spray white rice with synthetic forms of B vitamins. This was the beginning of food fortification laws which allowed rice, corn and wheat to be sprayed with synthetic isolates.

May Require Supplementation
High heat and overcooking destroy vitamin B-1. It is also eradicated in the body by antibiotics, caffeine, alcohol, food-processing, estrogen, sulfa drugs, air and water. The body's Thiamin requirements are increased during extended periods of diarrhea, chronic liver disease, kidney failure (when on dialysis), epileptics who use Dilantin (anti-seizure), and in those with severe malabsorption. Alcohol decreases the body's ability to absorb Thiamine.[2]

Symptoms of Nutrient Deficiency
- Beriberi
- Digestive Issues w/Protein Metabolism: Loss of Appetite, Indigestion, Severe Constipation, Lack of Hydrochloric Acid in the Stomach, Crohn's, Malabsorption
- Nervous System: Fatigue, Poor Memory, Peripheral Neuropathy (Loss of Sensation/Muscle Weakness), Muscle Pain, & Several Neurological Diseases
- Cardiovascular: Rapid Heartbeat & Sweating, Edema (due to the arteries & veins relaxing)
- Vision: Problems with Eye Movement
- Diabetes
- Emotional Instability, Depression, Irritability, Wenicke's Encephalopathy (where psychosis or brain damage occurs)

Food Sources
Beef, liver, Brewer's yeast, peas, beans, brown rice, raw fruits/vegetables, legumes, seeds, nuts, yogurt, spirulina.

Toxicity and/or Side Effects
Weakness, headache, rapid/irregular heartbeat, low blood pressure, convulsions.

Vitamin B-2 (Riboflavin)

Function
Riboflavin functions in closely interrelated manner with other B-Complex vitamins. It is a significant factor in body growth, the production of red blood cells, and also in the manner it affects metabolism through the releasing of energy from carbohydrates.

Vitamin B-2 treats bloodshot or itching/burning eyes, abnormal sensitivity to light, and cataracts. It corrects oily hair, oily skin, and premature wrinkles on the face and arms. Riboflavin also can correct splitting nails and a "disappearing" upper lip due to aging. It is also helpful in migraine prevention when supplemented along with magnesium and coenzyme Q10. Riboflavin is showing promise as a potential adjunct therapy in instances of cancer, although not yet tested on humans.

Deficiency may result in decreased conversion of B-6 to the coenzyme PLP which decreases conversion of tryptophan to niacin resulting in a reduction of bioavailable niacin. Folate metabolism can also be affected when B-2 is deficient. Iron absorption is often impaired which contributes to the manifestation of anemia. Additionally, intestinal loss of iron is increased, and utilization of iron when hemoglobin is synthesized is adversely affected. [3]

May Require Supplementation
Several antibiotics and drugs used to treat migraines (imipramine) can lead to inadequate B-2 levels. Riboflavin deficiency is rarely found in isolation; it occurs frequently in combination with deficiencies of other water-soluble vitamins.[3] Light, especially ultraviolet light and alkalis are destructive to vitamin B-2.

Symptoms of Nutrient Deficiency
- Glossitis/Magenta Tongue, Cheliosis & Angular Stomatitis, Sore Throat, Redness & Swelling of the Lining of the Mouth & Throat
- Skin: Moist, Scaly Skin Inflammation (Seborrheic Dermatitis)
- Preeclampsia, Eclampsia
- Vision: Cataracts, Corneal Disorders, Formation of Blood Vessels in the clear covering of the eye (Vascularization of the Cornea)
- Hypertension (in the MTHFR 677TT genotype)
- Trimethalaminuria (when not metabolized properly gives off a strong “fishy” odor in sweat, urine, reproductive fluids, and breath)
- Migraines in Adults[4] (not in children)

Food Sources
Almonds, milk, eggs, cheddar cheese, salmon, halibut, chicken, beef, organ meats, broccoli, asparagus, spinach, whole wheat.

Toxicity and/or Side Effects
When taking high doses of riboflavin there may be an increase in the rate of allergic reactions such as swelling of the face or tongue, hives, and difficulty breathing. However, no adverse effects have been reported from normal food or supplement ingestion or riboflavin given as a single IV dose. May cause harmless yellow-orange discoloration of urine.

Vitamin B-3 (Niacin)

Function
Niacin is a cholesterol-lowering, triglyceride-lowering vitamin which mellows the personality, relieves depression and grouchiness by raising the irritability threshold. B-3 can neutralize allergic reactions to peppers, pears, peaches, plums & nectarines while removing the associated headaches, indigestion, and skin problems. (Many Hiatus Hernia conditions result from an allergic reaction to these foods.) Vitamin B-3 can be useful to alleviate a toothache or a backache. It can also help smoking cessation by controlling cigarette cravings.

Other benefits of Vitamin B-3 include improving insulin secretion in Type 2 Diabetics as well as reducing the risk of Type I diabetes in high-risk children. A derivative of Niacin called Niacinamide (an amino acid) is a therapeutic treatment for osteoarthritis at 3 grams per day and for acne in a topical cream. Those who consume 17-45 mg per day from food/ multivitamins have a lower risk of developing Alzheimer's disease compared to those who consume less than 14 mg per day.

“The 3 D's” of Niacin deficiency are: Dermatitis, diarrhea, and dementia. They reflect the most common symptoms of deficiency involving the skin, digestive system, and nervous system. If left untreated, a fourth “D”, namely, “death” will occur, when Pellagra, a dark, thick, scaly rash develops in area exposed to sunlight.

May Require Supplementation
Niacin deficiency should be ruled out when working with the homeless population, individuals with anorexia nervosa or obesity, those on dialysis or who have cancer, and those who suffer from chronic alcoholism. There may be a deficiency in clients with Hartnup's disease, Crohn's disease, mega duodenum, carcinoid syndrome, and due to prolonged treatment with the anti-tuberculosis drug Isoniazid. Other pharmaceuticals including immunosuppressive drugs and Carbidopa prescribed for Parkinson's disease interfere with the tryptophan-kynurenine-niacin pathway. Note that those manifesting Pellagra often display additional vitamin deficiencies.

Symptoms of Nutrient Deficiency
- Skin: Dermatitis, Pellagra (late-stage niacin deficiency)
- Digestive: Inflammation of the Mouth and Tongue (bright red tongue), Vomiting, Constipation, Abdominal Pain, Diarrhea (which contributes to ongoing malnutrition)
- Neurological: Headache, Apathy, Fatigue, Depression, Disorientation, Memory Loss, Delirium
- Certain Food Allergies with Associated Headaches, Indigestion & Skin problems
- Anorexia & Obesity

Food Sources
Tuna, chicken, turkey, salmon, lamb, beef, organ meats, wild game, sardines, peanuts, shrimp, brown rice, mushrooms, broccoli, asparagus, kidney beans, bell peppers.

Toxicity and/or Side Effects
Side-effects are rare. The most apparent is a sudden blurring of vision. Other symptoms may be stomach upset/pain, gas, bloating, vomiting, diarrhea, nausea and skin flushing.

Vitamin B-4 (Choline)

Function
Vitamin B-4 is an essential micronutrient which is important in the process of methylation (DNA creation), brain function, nerve signaling, and detoxification. It acts as an anti-aging neurotransmitter, significant in the functioning of acetylcholine which in a like manner aids nerve signaling and the ability of muscle movement.

Choline works to maintain proper levels of acetylcholine in the brain, causing it to retain its elasticity. This is especially important for both nerve and brain functionality in the aging process. Choline is also important in forming LDL (the nefarious "bad") cholesterol as a certain level is necessary to maintain good health. Without LDL cholesterol, the body stores fat in the liver.

May Require Supplementation
When there has been a Traumatic Brain Injury, Choline may hasten the resorption of cerebral edema & improve recovery of consciousness and neurologic disorders. In mild to moderate injury, Choline may limit the duration and severity of post-traumatic symptoms such as: headache, dizziness, and attention disorder.

Adequate intake of folate is required so that the body can create and use choline. Those who obtain folate from leafy greens will require less choline supplementation. Vegetarians who consume no meat, milk, or eggs, may become deficient in choline.

Symptoms of Nutrient Deficiency
- NAFLD (nonalcoholic fatty liver disease) that resolves with supplementation. Untreated, about 1/3 of cases progress to the more serious NASH (nonalcoholic steatohepatitis.) Increased risk of cirrhosis and liver cancer also occur with deficiency.
- Vision: Optic Neuropathies, Glaucoma
- Learning Disabilities, Memory Loss, Age-related Cognitive Decline, Alzheimer's
- Mood Changes/Mood Disorders
- Low Energy Levels/Fatigue
- Muscle Aches
- Nerve Damage

Food Sources
Eggs, beef liver, salmon, shellfish, grass-fed beef, turkey, chicken breast, and goat milk. Peanuts, cauliflower, chickpeas, split peas, navy beans, spinach, beets, and Brussels sprouts.

Toxicity and/or Side Effects
"In 1998, the Food and Nutrition Board (FNB) of the Institute of Medicine established the tolerable upper intake level (UL) for choline at 3,500 mg/day for adults. This recommendation was based primarily on preventing hypotension (low blood pressure), and secondarily, on preventing fishy body odor due to increased excretion of trimethylamine. The UL was established for generally healthy people, and the FNB noted that individuals with liver or kidney disease, Parkinson's disease, depression, or inherited trimethylaminuria might be at increased risk of adverse effects when consuming choline at levels near the UL."[5]

Vitamin B-5 (Pantothenic Acid)

Function
Pantothenic Acid can be considered an "adrenal vitamin" which assists in producing stress hormones. It stimulates the adrenal glands and increases production of cortisones and other adrenal hormones. Pantothenic Acid will stop a "citrus allergy" (lemon, lime, orange, tangerine, grapefruit, tomato, pineapple, cantaloupes.) It is anti-aging and helpful in reversing hair loss, changes gray to natural color, corrects hypoglycemia (low blood sugar), corrects painful/burning feet, adrenal exhaustion and emotional sensitivity that can cause asthmatic attacks.
“Pantethine” has been proven effective and is used as a cholesterol-lowering agent in Japan.

Pantothenic Acid properly breaks down and assimilates fats, carbohydrates and proteins. It is key in the production of co-enzyme A, which is necessary in many metabolic processes.

May Require Supplementation
Supplementation should be considered for those with fatigue, allergies, high cholesterol, severe malnutrition, women on oral contraceptives/birth control pills that contain estrogen, people under chronic stress (physical/mental), alcoholics, those with impaired absorption of vitamins and minerals due to leaky gut, intestinal disorders and certain medications.

Symptoms of Nutrient Deficiency
- Numbness and Painful Burning and Tingling in the Feet
- Fatigue/Constant Tiredness
- Insomnia
- Depression, Irritability
- Low Immunity
- Inability to Relax or Cope with Stress
- Hypertension/Irregular Blood Pressure
- Digestive issues, Stomach pains, Vomiting, Low Metabolism
- Upper Respiratory Infections
- Muscle Cramps
- Weight Gain

Food Sources
Eggs, raw milk, organ meat (especially beef liver), trout, lobster, duck, avocado, sweet potato, portabella mushrooms, white mushrooms, peanuts, lentils, split peas, sun-dried tomatoes, whole milk yogurt, feta cheese, broccoli, cauliflower, sunflower seeds, and oranges.

Toxicity and/or Side Effects
Pantothenic acid is not known to be toxic. At very high intakes it may cause diarrhea. An overdose of PA (e.g. taking 1,000 mg over nine months without balancing the mineral sulfur will cause a sore throat, and a feeling of heaviness on the upper chest, along with an allergy to fats. Pantothenic Acid displaces sulfur in the body and large doses can potentially “compete with biotin for intestinal and cellular uptake by the human sodium-dependent multivitamin transporter (hSMVT).”[6]

Vitamin B-6 (Pyridoxine)

Function
Vitamin B-6 is synthesized from Beta Carotene in the healthy walls of the digestive tract. It helps the body convert food (carbohydrates) into fuel (glucose), which is used to produce energy and in the metabolism of fats and protein. Along with its derivative pyridoxal 5'-phosphate (P5P), Pyridoxine is essential to over 100 enzymes which are primarily involved in protein metabolism that result in healthy skin, hair, eyes, liver and nervous system function. B-6 aids the body's production of neurotransmitters, and supplementation is required for normal brain development and function. Vitamin B-6 supplementation may help reduce late-life depression in the elderly as it also assists in the production of serotonin, norepinephrine and melatonin.

B-6 may reduce Tardive dyskinesia, a side effect of long-term antipsychotic drugs involving involuntary movement. B-6 plus magnesium helps prevent calcium oxalate kidney stones. In conjunction with vitamins B-12, B-9, and betaine helps to control homocysteine in the blood thereby reducing the risk of cardiovascular disease. B-6 is necessary in order to absorb vitamin B-12.

May Require Supplementation
Vitamin B-6 is a catalyst in healing wheat allergies and may alleviate carpal tunnel syndrome. It is damaged by Estrogen, contraceptives, overcooked roasted or boiled foods, and alcohol. Supplementation is likely necessary if birth control pills, antibiotics, and theophylline (an asthma medication) have been used. Chronic inflammation impairs B-6 metabolism and smoking contributes to deficiency.

Symptoms of Nutrient Deficiency
- Anemia
- Affects the Peripheral Nerves in Adults
- In children, the Central Nervous System can be affected
- Muscle Weakness & Loss of Control
- Migraines
- Nervousness, Irritability, Depression, PMS, Senility, Short-term Memory Loss, Difficulty Concentrating
- Skin Disorders, Eczema
- Edema
- Kidney Stones
- Mucous Membranes: Sore Mouth & Lips, Halitosis
- Age-related Macular Degeneration (AMD)

Food Sources
Poultry, tuna, salmon, shrimp, beef liver, milk, cheese, lentils, beans, spinach, carrots, bananas, nuts, sunflower seeds, brown rice, wheat germ, bran, and whole-grain flour.

Toxicity and/or Side Effects
May cause muscular or nerve issues like nerve toxicity (tingling & changes in coordination), burning pains, clumsiness, a loss of muscle coordination and paralysis. Other symptoms may present as rapid breathing, dyspnea, and vivid dreams.

Vitamin B-9 (Folate)

Function
Vitamin B-9 aids the nervous system in functioning properly and is essential in the utilization of sugars and amino acids (protein). It is key in forming RBCs and for growth and division of all cells along with the production of RNA and DNA. It also aids in protein metabolism for blood cell division and builds antibodies to prevent and heal infection. Folate is found naturally in foods. Folic acid is the synthetic form of folate that is used in many supplements and is also added to processed, or "fortified," foods.

Folate can be analgesic for pain and prevent canker sores and premature graying, as well as correcting skin disorders such as grayish-brown skin pigmentation or reducing symptoms of vitiligo (white skin patches.) There is a protective effect against pancreatic cancer and pre-cancerous changes of the cervix when B-9 is taken in conjunction with B-12. Taken within the first three months of pregnancy, Folate can prevent cleft lip, cleft palate and spinal bifida. It may also assist in avoiding spontaneous abortion, difficult labor, neural tube defects, lower infant mortality, and improve lactation.

May Require Supplementation
Folate is damaged by heat, water, and sunlight and it is important to note that Vitamin C increases the excretion of folic acid. Supplementation may be needed for those taking antidepressants, barbiturates, corticosteroids, estrogen, birth-control pills, antacids, and NSAIDS (aspirin/ibuprofen). Only natural folate should be used for supplementation when a person has folic acid metabolism difficulty (MTHFR gene). Older adults may benefit from folate supplementation as blood homocysteine generally increases with age. High levels of homocysteine with insufficient folate is associated with cardiovascular disease. Congenital anomalies and neural tube defects may occur with low levels of folate during early pregnancy.

Symptoms of Nutrient Deficiency
- Neurological Birth Defects
- Brain function: Depression & Poor Memory
- Osteoporosis due to Raised Homocysteine Levels
- Megaloblastic Anemia (RBCs are larger than normal): Fatigue, Weakness, Shortness of Breath (use folate with B-12)
- Gingivitis, Red Tongue
- Cardiovascular Disease

Food Sources
Lentils, garbanzo and lima beans, asparagus, spinach, black-eyed peas, (Cos, Mesclun or Romaine) lettuce, escarole or endive, beets, potato skins, artichoke, turnip greens, collards, broccoli, Brussels sprouts, avocado, papaya, and raw orange juice.

Toxicity and/or Side Effects
Folic acid is water soluble and excreted in the urine so there is little risk of toxicity. However, "large doses of folic acid given to an individual with an undiagnosed vitamin B_{12} deficiency could correct megaloblastic anemia without correcting the underlying vitamin B_{12} deficiency, leaving the individual at risk of developing irreversible neurologic damage."[8] In high doses greater than 15,000 ug per day central nervous system damage can occur, presenting as movement disorders, paralysis, pain or numbness.

Vitamin B-12 (Cobalamin)

Function
Cobalamin is essential for maintaining healthy RBCs, nerve tissue, and DNA, as well as in metabolizing folate properly. Vitamin B-12 is bound to the protein in food and is released in the stomach during digestion by Hydrochloric acid. Once it has been released, it can recombine with intrinsic factor before being absorbed into the bloodstream.[9] Provided with sufficient B-12, the liver can then store it for up to five years.

May Require Supplementation
Those who practice strict vegetarianism, veganism, and the elderly are high risk for developing a deficiency if they do not eat fortified grains or supplement. Others at risk are those with increased Vitamin B-12 needs due to pregnancy and long-term illnesses such as anemia, hemorrhage, cancer, or liver or kidney disease. Additionally, older adults are more likely to suffer from B-12 malabsorption issues, therefore requiring supplementation.

Vitamin B-12 is damaged by alcohol, estrogen, sleeping medications, sunlight and water. Drugs such as "proton-pump inhibitors (e.g., omeprazole and lansoprazole), used for therapy of Zollinger-Ellison syndrome and gastroesophageal reflux disease (GERD), markedly decrease stomach acid secretion required for the release of vitamin B_{12} from food but not from supplements."[10] It is important to note that Cobalamin requires adequate B-6 for proper absorption.

Symptoms of Nutrient Deficiency
- Anemia & associated Fatigue
- Pernicious Anemia (more commonly found in the elderly, where vitamin B12 cannot be utilized in the body)
- One of the causes of Megaloblastic Anemia (in which the RBCs are larger than normal)
- Eating disorders: Bulimia, Anorexia Nervosa
- Skin: Dry & Cracked, especially at the corners of the mouth
- Numbness, Tingling, "pins and needles" Sensation
- Severe Joint Pain
- Ataxia (Shaky Movements & Unsteady Gait)
- Shortness of Breath
- Cognitive Decline: Memory Loss, Deep Depression (long-term deficiency), Paranoia & Delusions
- Incontinence
- Hypotension
- Loss of Taste & Smell

Food Sources
Eggs, fish, shellfish, meat, poultry, dairy products, eggs, and other animal foods.

Toxicity and/or Side Effects
This vitamin is water soluble and not generally toxic. Some people may develop blot clots, itching, diarrhea and serious allergic reactions if Cobalamin is taken in excess.

Vitamin 'B-x' PABA (Para-aminobenzoic Acid)

Function
PABA is a member of the B vitamin family as part of the Folic Acid molecule. It is produced internally by intestinal bacteria and sourced externally in food. It supports Folic Acid production by intestinal bacteria and maintains the intestinal flora. Supporting cells in general and of specific importance to red blood cells, PABA works as a coenzyme in the metabolism of and in the body's ability to use protein. Since PABA is stored in body tissues it may prevent abnormal accumulation of fibrous tissue.

PABA is known for its ability to restore hair color and may be used together with biotin, folic acid, pantothenic acid, and sometimes vitamin E to attempt to restore original hair color. Should the greying be due to stress or B-vitamin deficiency, PABA can be "used with inositol, folic acid and pantothenic acid (vitamin B5)"[11]

PABA has in the past been used externally as a sunscreen, however, it has a propensity to cause allergic reactions in a certain percentage of people and it also stains clothing. Because of this, it is no longer popularly used in sunscreen products.

"No RDA is listed for PABA. It is available in supplements of 50–1,000 mg. Up to 1,000 mg. are used therapeutically in a time-released capsule, although the common treatment amount is usually about 50–100 mg. three times daily. If we take antibiotics, we might increase our intake of PABA for a while, although PABA taken with sulfa antibiotics may reduce their effectiveness. A therapeutic approach used by some authorities to attempt to restore normal hair color is 1,000 mg., time-released, daily for six days a week, taken with 400 mcg. of folic acid. "[12]

May Require Supplementation
Deficiency issues occur more frequently with the use of antibiotics since antibiotics alter the functioning of intestinal bacteria and consequently, the production of PABA.

Symptoms of Nutrient Deficiency
- Fatigue
- Irritability, Depression, Nervousness
- Long-term Antibiotic Use (including Sulfa Drugs)
- Frequent Headaches
- Weeping/Moist Eczema
- Premature Skin Wrinkling and/or Gray Hair
- Constipation & Other Digestive Symptoms

Food Sources
Liver, organ meats, Brewer's yeast, wheat germ, eggs, molasses, bran, mushrooms, spinach, whole grains.

Toxicity and/or Side Effects
High doses are not recommended as excess PABA is stored in the body. Too much PABA may irritate the liver, cause anorexia and rarely vitiligo. Side effects generally arise from allergic reactions or acidity such as: "coma, diarrhea, dizziness, fever, liver damage, nausea, skin rashes, shortness of breath, slowed breathing, stupor, and vomiting."[11]

Vitamin C (Ascorbate)

Function
Vitamin C is another water-soluble nutrient. It is well-known for its immune-stimulating effect offering the body protection from viral and bacterial infection. It also inhibits histamines and therefore is helpful in managing allergies and other allergic reactions. Another of its amazing properties is the ability to neutralize harmful free radicals, pollutants and toxins in addition to prolonging the lifespan of cells within the body. Vitamin C has the ability to help keep carcinogenic nitrosamines from forming in the stomach due to the consumption of nitrite-containing foods.

As a hemostat, Vitamin C prevents hemorrhaging and bleeding at the cellular-level and acts as a "cement" for connective tissues. It is found in high levels in the dermis and even higher levels in the epidermis making it important in healing wounds to the skin. Topical applications of ascorbic acid will pass through the epidermis into the dermal layers underneath. "Ascorbic acid is a powerful enhancer of nonheme iron absorption and can reverse the inhibiting effect of such substances as tea and calcium/phosphate. Its influence may be less pronounced in meals of high iron availability--those containing meat, fish, or poultry."[13]

May Require Supplementation
Degradation of Vitamin C can occur with excessive exposure to light, heat, oxygen, alkalinity, and cigarette smoking. Remember, illnesses with fever will "burn" up vitamin C in the body. Other issues include aging, "…inflammatory disorders (particularly diarrheal disorders), Achlorhydria [the absence of hydrochloric acid in gastric secretions], smoking, hyperthyroidism, iron deficiency, cold or heat stress, surgery, burns, and protein deficiency."[14]

Symptoms of Nutrient Deficiency
- Connective Tissue Defects (Bleeding Gums/Gingivitis, Petechiae, Rash, Internal Bleeding, Impaired Wound Healing
- Bone Growth Impairment in Children & Infants
- Fatigue, Lethargy, and/or Weakness
- Depression, Irritability, Weight Loss
- Vague Muscle and/or Joint Pain
- Bleeding or Effusions within Joints
- Femoral Neuropathy/Hemorrhage into Femoral Sheaths (mimics deep vein thrombosis)
- Edema in the Lower Extremities
- Severe => Scurvy (Hemorrhagic Manifestations, Abnormal Osteoid/Dentin Formation)

Food Sources
Egg yolks, chili peppers, red or green bell peppers, kale/dark leafy greens, broccoli, cauliflower, Brussels sprouts, papaya, strawberries, kiwi, mango, citrus fruits, acerola cherry, and melons.

Toxicity and/or Side Effects
Over 2000 mgs. daily may cause nausea and diarrhea. Therefore, build up slowly. There is a chance that extremely high daily doses may have damaging effects on DNA.

Vitamin D-3 (Calcitriol)

Function
The Vitamin D receptors in every cell make this a crucial nutrient for the body to function. Vitamin D_3 has a significant role in calcium metabolism, muscle development, and healthy bones and teeth. It is also the only vitamin that is a hormone. Therefore, it plays many roles in such things as mental health, blood sugar regulation, the immune system, and the prevention of cancer. Vitamin D also pulls the mineral calcium into the bones.

May Require Supplementation
Magnesium regulates key enzymes in the metabolism of Vitamin D; therefore, Magnesium deficiency may negatively affect Vitamin D levels. Also, Vitamin D is damaged by mineral oil. High levels of melanin in those with darker skin impairs absorption of vitamin D. Those who are obese or have liver disease, celiac, impaired kidney function, IBS, fat malabsorption syndrome, Crohn's, and the elderly tend to be deficient in this nutrient. People who wear a concealed clothing style or severely limit sun exposure (sunlight is required to turn cholesterol into Vitamin D) are also at risk as are exclusively breast-fed infants, and older infants and toddlers who are fed unfortified milk substitutes exclusively. Low-cholesterol diets may be deficiency as cholesterol is a precursor to Vitamin D.[15] Genetic bioavailability of Vitamin D-binding protein (DBP) varies among individuals. Environmental factors such as air pollution, cloud cover, and geographical locations far from the equator may also be implicated.

Symptoms of Nutrient Deficiency
- Rickets (in infants/children), Weak Bones (Osteomalacia), Throbbing & Aching Bone Pain
- Excessive Sweating in Newborns due to Neuromuscular Irritability (an early symptom)
- Muscle Weakness & Pain
- Unhealthy Teeth; Sweaty Head; Gut Issues, Unable to absorb fat. (i.e. Crohn's)
- Seborrheic Keratosis (Barnacles of Aging)
- Depression & Seasonal Affective Disorder (SAD)

Vitamin D insufficiency may be a contributing etiological factor in osteopenia/osteoporosis; cancers, especially colorectal cancer, breast cancer, and prostate cancer; autoimmune diseases such as type 1 diabetes, multiple sclerosis, rheumatoid arthritis, and systemic lupus erythematosus. Cardiovascular diseases like hypertension and endothelial dysfunction. Type II diabetes mellitus; neurodegenerative diseases having cognitive impairment, Alzheimer's; and Parkinson's. Adverse Pregnancy Outcomes (small-for-gestational-age/low birth weight infants,) and gestational diabetes mellitus. Acute respiratory infections, asthma, and COPD; atopic dermatitis (eczema); IBS; and celiac or non-celiac gluten sensitivity

Food Sources
Pink Salmon/Mackerel/Sardines – canned, egg yolk, and lard from pasture-raised pigs.

Toxicity and/or Side Effects
Fat-soluble vitamin D is stored in fat cells and can accumulate. Too much can cause toxicity, but overdose amounts are different for everyone. For example, children should not take more than 400 iu daily. Vitamin A and D will offset each other's toxicity. Fortunately, most foods high in Vitamin D are also high in Vitamin A. It would be wise to consume those foods in which both nutrients occur or when supplementing to use both. It is important to take Vitamin K_2 with Vitamin D3 to prevent calcification in the body's soft tissues and arteries.

ADDITIONAL INFORMATION: by Sharlene Peterson/Genesis School of Natural Health

Bioactive vitamin D, calcitriol, is a steroid hormone that is best known for its role in regulating body levels of calcium and phosphorus, and in mineralization of bone. More recently, it has become clear that receptors for vitamin D are present in most, if not all, cells of the body. Vitamin D has biologic effects within the immune modulation (T and B cells, macrophages, and monocytes), cell differentiation and proliferation, and inflammation regulation. Vitamin D receptors are also found in the uterus, testis, ovary, prostate, placenta, mammary glands, pancreas, pituitary, thyroid, adrenals, smooth and skeletal muscles, heart muscle, brain, skin, and liver.

Synthesis: Vitamin D_3, also known as cholecalciferol is manufactured in the skin of animals when light energy is absorbed by the precursor molecule 7-dehydrocholesterol. The plant form of vitamin D is called vitamin D_2 or ergosterol. Diet alone does not provide enough vitamin D for humans. Sunscreens, especially those with SPF ratings greater than 8, effectively block synthesis of vitamin D in the skin.

Vitamin D, as either D_3 or D_2, must be metabolized within the body to become the hormonally-active form known as 1,25-dihydroxycholecalciferol. This transformation occurs in two steps:

Within the liver, cholecalciferol is hydroxylated to *25-hydroxycholecalciferol* by the enzyme 25-hydroxylase.

Within the kidney, 25-hydroxycholecalciferol serves as a substrate for 1-alpha-hydroxylase, yielding *1,25-dihydroxycholecalciferol*, the biologically active form.

"In the United States, between 25% and 50% of the adult population has vitamin D deficiency. In patients with chronic liver diseases, the prevalence of vitamin D deficits is much higher and practically universal. Up to 93% of patients with chronic liver disease have insufficient vitamin D levels, and almost one-third of these show severe deficiency."…"Vitamin D deficiency has been frequently reported in many causes of chronic liver disease and has been associated with the development and evolution of non-alcoholic fatty liver disease (NAFLD) and chronic hepatitis C (CHC) virus infection." (Iruzubieta P, Terán Á, Crespo J, Fábrega E. Vitamin D deficiency in chronic liver disease. *World Journal of Hepatology*. 2014;6(12):901-915. doi:10.4254/wjh.v6.i12.901.)

Liver or kidney disease can interfere with production of the biologically-active form of vitamin D and a deficiency of vitamin D may lead to liver disease. Double-edged sword scenario. Non-alcoholic fatty liver disease (NAFLD) affects almost 30% of the U.S. population and it is the leading cause of chronic liver disease in children and adolescents. NAFLD is defined as the accumulation of excessive fat in the liver in the absence of excessive drinking of alcohol and any secondary cause.

Vitamin E (RRR-Alpha Tocopherol)

Function
Fat-soluble Vitamin E is a powerful antioxidant that serves to clear the body of toxins. It also regulates enzymatic activity affecting proper growth of muscles, and effects gene expression by modulating the growth of connective tissue and therefore is important in wound repair and in the regeneration of tissue lost or damaged amid atherosclerosis. Vitamin E inhibits the coagulation of platelets. Be aware that too much can cause hemorrhaging. It is important in neurological functioning and protects lipids and impedes deterioration of polyunsaturated fatty acids.

May Require Supplementation
Cigarette smokers, those with fat malabsorption disorders, malnutrition, or genetic abnormalities that affect the Vitamin E transport mechanism can cause deficiency. "The developing nervous system appears to be especially vulnerable to vitamin E deficiency. For instance, children with severe Vitamin E deficiency at birth rapidly experience irreversible neurologic symptoms if not treated with Vitamin E."[16] Vitamin E is damaged by frost, oxygen, chlorine, heat and iron.

Symptoms of Nutrient Deficiency
- Fertility Issues (especially in the very early stages of pregnancy)
- Myopathy (Muscle weakness) & Skeletal Myopathy
- Neurologic: Spinocerebellar Ataxia, Ataxia (gait/muscle coordination issues), Peripheral Neuropathy
- Vision: Retinopathy
- Red Blood Cell destruction

Food Sources
Oils: wheat germ, sunflower, safflower, grapeseed, olive. Nuts: sunflower seed kernels, almonds, hazelnuts, peanuts, pecans, peanut butter. Vegetables: tomatoes, asparagus, Swiss chard, broccoli. Fruits: cranberry, apricots, avocado, blackberries (raw). Fish: rainbow trout.

Toxicity and/or Side Effects
Few side effects noted in adults who take less than 2,000 mg of natural or synthetic Vitamin E per day. "Large doses of vitamin E may inhibit Vitamin K-dependent carboxylase activity and interfere with the coagulation... the use of Vitamin E supplements may increase the risk of bleeding in individuals taking anticoagulant drugs (blood thinners), such as heparin and the Vitamin K antagonist, warfarin (Coumadin); antiplatelet drugs, such as clopidogrel (Plavix), ticlopidine (Ticlid), tirofiban (Aggrastat), and dipyridamole (Aggrenox); and non-steroidal anti-inflammatory drugs (NSAIDs), including aspirin, ibuprofen, and others. In addition, individuals who may be Vitamin K deficient due to liver failure, those with a propensity to bleed (e.g., bleeding peptic ulcers), and those with inherited bleeding disorders (e.g., hemophilia) or a history of hemorrhagic stroke, should not take α-tocopherol supplements without close medical supervision because of the increased risk of hemorrhage. Finally, it cannot be excluded that Vitamin E would potentiate the antithrombotic activity of supplemental fish oils and herbal products, such as garlic, curcumin, or Ginkgo biloba "[11] Discontinuing high-dose supplementation two to four weeks prior to elective surgery (or dental procedures) may reduce the risk of hemorrhage.

Vitamin H (Biotin)

Function
Biotin is manufactured by a majority of intestinal bacteria including Bifidobacterium bifidus. Biotin causes the body to convert food into glucose which produces energy. It can also make both fatty and amino acids, and activate protein/amino acid metabolism in the hair roots and fingernail cells.

"Biotin is used in the treatment of an inherited disorder of Thiamin transport, called biotin-responsive basal ganglia disease, and is currently being tested in trials to limit or reverse functional disabilities in individuals with multiple sclerosis."[7]

May Require Supplementation
Those on long-term anticonvulsant (anti-seizure) medicines, especially, primidone (Mysoline), phenytoin (Dilantin), and carbamazepine (Carbatrol, Tegretol). Anticonvulsants used to prevent epileptic seizures increase the risk of Vitamin B-7 depletion. Valproic acid, an anticonvulsant given to children that causes hair loss, has been successfully reversed by biotin supplementation. Sulfa drugs taken long-term may decrease bacterial synthesis of biotin.

The need for biotin is likely increased during pregnancy because of the rapidly dividing cells of the fetus and during breastfeeding. Adequate levels of biotin are essential for healthy fetal development according to animal studies, while biotin deficiency may pose greater risk for congenital anomalies. Smoking increases biotin catabolism. Alcohol use may inhibit transportation of biotin across the intestinal wall. Also, those who have been on intravenous nutrition for a long time as well as those with conditions such as Crohn's disease where nutrients are absorbed inadequately are also at risk of deficiency.

Symptoms of Nutrient Deficiency
- Fatigue
- Thinning Hair & Hair Loss, Dry Scaly Skin and/or Thin Brittle Nails
- Seborrheic Dermatitis (Cradle cap) in infants
- Muscle Weakness & Pain
- Poor/Loss of Appetite
- Glossitis (Swollen & Painful Tongue, Magenta in Color)
- Depression
- Nausea
- Poor Blood Sugar Control in Type I & Type II Diabetics
- Peripheral Neuropathy (resulting from Diabetes or Kidney dialysis)
- Cheilitis (Cracking in the Corners of the Mouth)
- Dry Eyes
- No Sense of Taste

Food Sources
Brewer's yeast, Egg yolk, liver, kidney, milk cheese, and cauliflower.

Toxicity and/or Side Effects
No known toxicities.

Vitamin K_1 (Phylloquinone) & K_2 (Menaquinone)

Function
Vitamin K is a fat-soluble vitamin made up of 25 percent Phylloquinone (K_1), which is derived from dietary sources. Vitamin K_1 is important for maintaining bone density and coagulation of the blood. Important to injury and wound healing, K_1 is key to the mineralization of bone.

The remaining 75 percent is made up of Menaquinone (K_2), a small portion of which is converted from K_1 into K_2 by bacteria in the colon (large intestine), the balance is derived from food sources. Vitamin K_2 is an immune system booster, it protects cells against oxidative damage, regulates blood sugar levels and the calcification of soft tissues, and has been demonstrated to promote heart health.

May Require Supplementation
Oral K_1 drops are recommended for infants to thwart possible Vitamin K_1 deficiency bleeding (VKDB) a condition formerly known as "classic hemorrhagic disease of the newborn." This can occur up to 12 weeks in exclusively breast-feed infants due to the low Vitamin K_1 content of breastmilk or in infants with malabsorption issues or where the newborn may not have a fully functional Vitamin K cycle. Infants whose mothers take anticonvulsant medication should also be supplemented.

Those with liver damage/disease, fat malabsorption and other gastrointestinal disorders including IBS, cystic fibrosis, celiac disease, ulcerative colitis, and short bowel syndrome may not absorb Vitamin K properly and should be considered for supplementation.

Antibiotics eliminate K_2-producing bacteria in the intestines. Additionally, cephalosporin antibiotics may also inhibit the action of Vitamin K throughout the body. Bile acid sequestrants, such as cholestyramine and colestipol, reduce the absorption of Vitamin K and other fat-soluble vitamins as well as the intended effect of reducing cholesterol. When used in conjunction with warfarin (a blood thinner) blood clotting ability may be delayed. Warfarin and other anticoagulant medications antagonize the activity of Vitamin K, depleting its ability to clot blood. It is important to maintain a consistent intake of Vitamin K from food and supplements because sudden changes can increase or decrease the blood's ability to clot effectively. Vitamin K is also damaged by salicylates (aspirin) and barbiturates.

Symptoms of Nutrient Deficiency
- Bleeding Gums, Nose Bleeds
- Easily Bruises
- Anemia
- Increased Menstrual Bleeding

Food Sources
High K_1, Low K_2 – Dark green leafy vegetables, basil, scallions, endive, olive oil,
Low K_1, High K_2 – Meat, liver, poultry, eggs, cheese, and butter

Toxicity and/or Side Effects
Vitamin K has no reported toxicity.

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http://www.dietitians.ca/Your-Health/Nutrition-A-Z/Vitamins/Food-Sources-of-Folate.aspx
http://lpi.oregonstate.edu/mic/vitamins/folate
https://www.healthaliciousness.com/articles/foods-high-in-folate-vitamin-B9.php

Vitamin B-12 (Cobalamin)
[9] http://www.uhhospitals.org/health-and-wellness/health-library/d-h/eating-disorders-malnutrition
[10] http://lpi.oregonstate.edu/mic/vitamins/vitamin-B12#food-sources

Vitamin 'B-x' PABA (Para-aminobenzoic Acid)
[11] http://www.healthsupplementsnutritionalguide.com/PABA.html
[12] http://www.healthy.net/Health/Article/PABA_Para_aminobenzoic_Acid/2132

http://www.healthy.net/Health/Article/PABA_Para_aminobenzoic_Acid/2132
http://www.livestrong.com/article/134435-what-is-paba-sunscreen/

Vitamin C (Ascorbate)
[13] http://www.ncbi.nlm.nih.gov/pubmed/6940487
[14] http://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency,-dependency,-and-toxicity/vitamin-c
http://www.dsm.com/products/quali-c/en_US/vitamin-c/functions.html
http://lpi.oregonstate.edu/mic/micronutrients-health/skin-health/nutrient-index/vitamin-C
http://www.globalhealingcenter.com/natural-health/foods-high-in-vitamin-c/

Vitamin D-3 (Calcitriol)
[15] http://www.cholesterol-and-health.com/Vitamin-D.html
http://www.skinsite.com/info_seborrheic_keratoses.htm
https://www.psychologytoday.com/blog/the-breakthrough-depression-solution/201111/psychological-consequences-vitamin-d-deficiency
http://articles.mercola.com/sites/articles/archive/2014/05/28/vitamin-d-deficiency-signs-symptoms.aspx
http://lpi.oregonstate.edu/mic/vitamins/vitamin-D#severe-deficiency

Vitamin E (RRR-Alpha Tocopherol)
[16,17] http://lpi.oregonstate.edu/mic/vitamins/vitamin-E#marginal-deficiency
https://en.wikipedia.org/wiki/Vitamin_E
http://lpi.oregonstate.edu/mic/vitamins/vitamin-E
http://lpi.oregonstate.edu/mic/vitamins/vitamin-E#toxicity

Vitamin H (Biotin)
[7] http://lpi.oregonstate.edu/mic/vitamins/biotin
http://lpi.oregonstate.edu/mic/vitamins/biotin
http://www.dsm.com/markets/foodandbeverages/en_US/products/vitamins/biotin.html

Vitamin K_1 (Phylloquinone)
Vitamin K_2 (Menaquinone)
http://www.nutrex-hawaii.com/natural-vitamin-b12-k1-and-k2-source
http://articles.mercola.com/sites/articles/archive/2014/08/12/vitamin-k-shot-newborns.aspx
https://www.healthaliciousness.com/articles/food-sources-of-vitamin-k.php
https://ods.od.nih.gov/factsheets/VitaminK-HealthProfessional/#h8

Part Two… MINERALS

Minerals are inorganic compounds relevant to human nutrition which are composed of substances neither plant or animal and that provide structure and function to every living cell. Minerals also function in the body as co-enzymes in a similar manner to vitamins.

While most people think of minerals as rock formations in the earth, these are actually made up of mineral salts which are inorganic acids. Our bodies are not designed to break down these rock mineral 'salts' into absorbable, useable elements. Instead, humans and animals need to get their minerals from plants. Plants have special enzymes in their roots that do this task and further convert the minerals into a bioavailable form useful for humans or animals. Suitable minerals for humans are derived from both plants or herbivores.

Many minerals are considered essential metals such as calcium, chromium, copper, iron, magnesium, molybdenum, potassium, sodium, and zinc. Their job is to activate enzymes in the body. They are important in the formation of tissues, blood, bones, and teeth, the healthy functioning of the brain and organs, as well as the regulation of body fluids.

The minerals required by the body in larger amounts are called macrominerals. There are seven of them: calcium, chloride, magnesium, phosphorus, potassium, sodium, and sulfur. Minerals required, but in lesser amounts are called microminerals or 'trace' minerals. They are needed by the body in miniscule amounts of less than 20 mgs per day. There are many trace minerals. The most common ones that we will discuss here are: boron, chromium, cobalt, copper, fluoride, iodine, iron, manganese, molybdenum, selenium, vanadium, and zinc.

Vitamins and minerals do not work in isolation. They often work together in groups and the deficiency of just one nutrient can cause a malfunction in the action of the group. For instance, think of the nutrients required for healthy bones. As we are all aware, calcium is necessary for healthy, strong bones and teeth. However, so are the correct proportions of vitamin D, magnesium, zinc, fluoride, phosphorus, chloride, copper, manganese, and sulfur. When just one of these nutrients are out of balance, the whole system suffers and ultimately the quality of bone material is weakened.

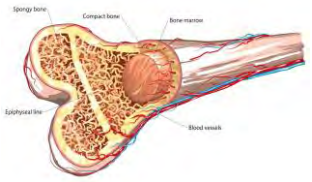
Magnesium is just one important mineral that is required in over 300 processes and in nearly 800 enzyme systems throughout the body. Magnesium is also necessary for the proper metabolism of vitamin D. With m any such significant roles it is mind-boggling that over 80 percent of people are deficient in this one mineral alone!

Taking either copper and zinc to the exclusion of the other is detrimental as they both are required to balance one another. Too much iron has the potential to cause a zinc deficiency. Additionally, vitamin D without sufficient vitamin K may cause the increased absorption of calcium which can deplete the body's magnesium stores.

It is difficult to obtain the minerals the body needs from diet alone. Many years of conventional farming methods have depleted the topsoil of the vitamins, minerals, and microbiota that plants need to produce nutritious food. This makes supplementation a necessity for most people.

MACROMINERALS

Calcium (Ca)



Function
Calcium, the most abundant mineral in the human body, is important for healthy bones and teeth; for nerve function, especially those that help muscles as well as blood vessels relax and contract; blood clotting; blood pressure regulation; immune system health; and blood clotting. Specific blood calcium levels must be maintained for the body to have normal functioning. This narrow range of blood calcium is so important to the body that it will pull the mineral from the skeleton (where about 99 percent of the calcium should be stored) when blood-level calcium is not sufficient.

In North America the tendency toward deficiency due to dietary intake of Calcium is minimal. Deficiency in these instances generally results from malabsorption due to other nutrient or pH deficiencies. For example, when stomach acid becomes too alkaline it influences blood pH to become overly alkaline as well. Alkalosis occurs when optimal blood pH exceeds its narrow range of 7.35 to 7.45. This over-alkalization can occur as a result of extreme dietary alkalinizing protocols, ingesting antacids or other medications which further alkalinize stomach acids, vitamin and mineral imbalances, as well as problems with the kidneys or other organs.

When vitamin D is excessive (as in the case of extreme supplementation) or simply is not being absorbed properly, the fatty acids in the body tend to combine with calcium to form deposits throughout the body. One form of malabsorption occurs when cortisol blocks the absorption of vitamin D at the time it is released from the adrenal glands during the stress response. Another occurs when not enough bile is available to break down the fats which help assimilate vitamin D. In either case, the fats are then stored in the liver and kidneys and do not correctly process the calcium into the bloodstream. With the help of vitamin F (otherwise known as essential fatty acids or EFA) found in flax and cod liver oils, calcium is then taken to the next level into the tissues and bones for proper storage.

When calcium cannot get into the bones to be stored and the upper limit of the blood range of calcium is reached the body must find other places to store this excess mineral because it then creates havoc within the body to remain in the bloodstream. Thus, we find that calcium mixed with fatty acids can build up throughout the body. It is found deposited in tissues that have experienced chronic inflammation or injury including surgery, radiation, trauma and/or infection, on top of bones and nerves, and also within the arteries as a component of plaque. “Bad” cholesterol is most often blamed but the buildup is actually a mixture of fatty acids and excess blood calcium.

Calcium crystals often deposit in the joints. They can cause ailments such as arthritis, bursitis, and tendonitis as they deposit on the ligaments that run along the spine/body, as well as on the heel, termed heel spurs. Buildup on the nerves can cause symptoms like twitching in the eyes or face. Other manifestations of calcium deposits include cataracts, cramps in the lower calves, kidney or gallbladder stones, and calcification of the arteries (atherosclerosis.)
Vitamin D_3 is necessary to increase the absorption of calcium into the blood only. To transfer calcium into the bone and tissues K_2 must be included with D_3 supplementation. In the case of excess vitamin D, calcium is taken from the stomach and concentrated into the blood. Stress, especially chronic stress, causes blood pH to rise. When the blood becomes too alkaline, calcium is not transported properly. Excess cortisol secreted during periods of chronic stress

both depletes and blocks the proper absorption of vitamin D. This in turn affects the absorption of, and along with Vitamin K_2, the proper storage of calcium. The result of too much Vitamin D and not enough Vitamin K_2 is the body working to keep blood calcium in the proper range and creating calcium deposits as a means to maintain a proper calcium balance in the circulating blood.

Another cause of dietary calcium not being absorbed properly is due to insufficient bile production by the liver or lack of a gallbladder. Bile is necessary to break down fat, especially fat-soluble vitamins like A, D, E, F & K. Since Vitamin K_2 is instrumental in the transfer of calcium into bones and tissues, bile supplementation may be helpful.

Calcium and Magnesium are the two most common alkaline earth metals whose metabolism is closely related in the human body. The two minerals are antagonistic toward one another in the way they work in the body. One example of this is while calcium is utilized in muscle contraction, magnesium is utilized in muscle extension. "As a general rule, the more rigid and inflexible our body structure is, the less calcium and the more magnesium we need... A healthy cell has high magnesium and low calcium levels. The higher the calcium level and the lower the magnesium level in the extra-cellular fluid, the harder is it for cells to pump the calcium out. The result is that the mitochondria gradually calcify and energy production decreases with low magnesium levels… Some researchers estimate that the American ratio of calcium to magnesium is actually approaching 6:1, while the recommendation for healthy living is actually 2:1." [18]

May Require Supplementation
Supplementation may be considered if one tests for a low blood calcium level (hypocalcemia) as it implicates abnormal parathyroid functioning. "Other causes of abnormally low blood calcium concentrations include chronic kidney failure, vitamin D deficiency, and low blood magnesium levels often observed in cases of severe alcoholism. Magnesium deficiency can impair parathyroid hormone (PTH) secretion by the parathyroid glands and lower the responsiveness of osteoclasts to PTH. Thus, magnesium supplementation is required to correct hypocalcemia in people with low serum magnesium concentrations.

Chronically low calcium intake in growing individuals may prevent the attainment of optimal peak bone mass. Once peak bone mass is achieved, inadequate calcium intake may contribute to accelerated bone loss and ultimately to the development of osteoporosis."[19] Caffeine ingested in large amounts depletes urinary calcium for a short time. Soft drinks and food additives tend to be high in phosphates which also cause the excretion of calcium in the urine. This is detrimental to bone health.

Symptoms of Nutrient Deficiency (Hypocalcemia)
- Anxiety, Anger, Confusion, Depression, Hallucinations, Memory Loss
- Facial Twitching
- Lightheadedness
- Slow Heartbeat
- Brittle Bones, Weak Hair/Nails, Slow Hair Growth, Fragile or Thin Skin
- Numbness and/or Tingling in Hands, Feet, and Face/Lips
- Seizures
- Muscle Cramps, Muscle Spasms (tetany), Muscle Weakness
- Low Blood Calcium Level (hypocalcemia) which implicates abnormal parathyroid functioning

Symptoms of Nutrient Excess (Hypercalcemia)

- Can be Asymptomatic
- Depression (Excess calcium interferes with the absorption of magnesium and can be a root cause of depression)
- Excessive Thirst/Urination, Loss of Appetite
- Stomach Upset, Nausea, Vomiting, Constipation & Abdominal Pain (Dehydration keeps the kidneys from expelling excess calcium from the blood)
- Muscle Weakness, Lethargy, Fatigue
- Confusion, Delirium, Loss of Consciousness, Coma, Death
- Headaches
- Hyperparathyroidism or Excessive Thyroid Hormone
- Milk Alkali Syndrome
- Kidney/Gall Stones
- Irregular Heartbeat
- Certain Cancers/Tumors (that cause breakdown of bone and/or impair the kidney's removal of calcium from the blood)

Food Sources

Milk, yogurt, cheese, leafy greens, seafood, sardines, legumes, sesame seeds, fruit, and nuts. Examples: Kale (cooked) 1 cup has 245 mg (24% DV); Sardines (with bones) 2 ounces has 217 mg (21% DV); Yogurt or Kefir 6 oz has 300 mg (30% DV); Broccoli 1 ½ cup cooked has 93 mg (9% DV); Watercress 1 cup has 41 mg (4% DV); Cheese 1 ounce has 224 mg (22% DV)

Toxicity and/or Side Effects

One of the worst sources of the mineral is calcium carbonate, which is essentially "limestone." The human body is not made to digest minerals directly, rather, plants with root enzymes and the microorganisms that surround them in the soil are what breaks natural mineral sources down for the plants. Our bodies are designed to get the minerals which have been modified for our digestive systems from plants, not from the rocks directly. "Decades ago, ulcer patients were told to eat lots of milk and cream and take sodium bicarbonate (an alkali) to neutralize acid and protect the stomach lining. Some of these patients (2% to 18%, depending on the study) developed a life-threatening condition called milk alkali syndrome, characterized by high blood calcium, high blood pH, kidney dysfunction, and calcifications of the cornea, lung, and lymph nodes.

The syndrome pretty much disappeared when this ulcer treatment was abandoned, but it has re-emerged, mainly among women taking high doses of calcium carbonate in supplements as well as antacids such as Tums, which contain calcium carbonate. In one study, Texas researchers examined the charts of all patients admitted to a university hospital for high calcium levels between 1998 and 2003. After excluding patients with kidney disease and hyperparathyroidism, they found that milk alkali syndrome was the culprit in 9% of cases overall and 26% of those involving very high blood calcium levels. The syndrome is more likely to occur in people who consume more than 2,000 milligrams (mg) per day of elemental calcium — that is, the amount of calcium in the supplement rather than the amount of the supplement itself, which is usually calcium carbonate. (A 500-mg tablet of calcium carbonate typically contains 200 mg of elemental calcium.) Also at risk are women who combine high-dose calcium with vitamin D to increase its absorption. Dehydration, a risk for women with bulimia or chronic morning sickness, can also raise calcium levels by upsetting the blood's acid-base balance."[20]

Chloride (Cl-)

Function
Chloride is very soluble in water and is found, primarily, in body fluids. It is a negatively charged ion of the blood representing 70% of the body's total negative ions. Chloride is one of the main electrolytes in the body due to this negative charge and brings balance to the positive charges of sodium and potassium ions. These electrolytes are found in all body fluids such as the blood, lymph and inter- and intra-cellular fluids. The balance of positive and negative ions serves to conduct electrical impulses through body fluids and cells by moving fluid in and out of the cells and in transmitting nerve impulses. This is called serum osmolity.[32]

Chloride is a key element in metabolism because its ions are secreted in the gastric juice as hydrochloric acid, which is essential for the digestion of food. It is also responsible for maintaining proper blood volume, blood pressure, and the pH of body fluids. The overall concentration of chloride in the blood is controlled by the kidneys with a daily loss of near 530 mgs. Chloride levels in the blood generally rise and fall along with sodium levels in the blood.

May Require Supplementation
Chloride deficiency is not common, but may occur with heavy sweating during endurance exercise or when there is illness prolonged vomiting or diarrhea. Active adults that eat a generally healthy diet, yet whose salt intake is low may need supplementation. Hypochloremia (low chloride) may result from water overload, wasting conditions, and extensive bodily burns with separation of extracellular fluids. In a situation in which infants were inadvertently fed chloride-deficient formula, many experienced 'failure to thrive', anorexia, and weakness in their first year of life.[33]

Symptoms of Nutrient Deficiency
- Alkalosis
- Muscle Weakness/Twitching/Spasms
- Profound Lethargy
- Loss of Appetite
- Irritability
- Dehydration
- Shallow Breathing

Food Sources
Sea salt, kelp (seaweed), olives, rye, tomatoes, lettuce, and celery.

Toxicity and/or Side Effects
Chloride is not known to have negative health effects on the body. Generally, any negative effects associated with chloride can actually be attributed to potassium and sodium to which chloride is frequently attached. "Too much chloride can be associated with rapid deep breathing, weakness, confusion, and coma."[34] Although it is related, the mineral chloride should not be confused with the dangerous gas that is chlorine. To become chloride, chlorine must gain one ion (CL^-).[35]

Magnesium (Mg)

Function
Magnesium is stored in the bone and is important in the formation of strong and healthy bones and teeth. The body also utilizes magnesium in the making of protein, in muscle contraction, nerve transmission, and immune system health. Magnesium is also necessary in the energy conversion of foods we eat, cellular repair, and body temperature regulation. As an antioxidant, magnesium is also necessary for the production of ATP within the cells of the heart muscle. Additionally, proper calcium metabolism is dependent upon having adequate amounts of magnesium in the bloodstream.

“Magnesium is an old home remedy for all that ails you, including "anxiety, apathy, depression, headaches, insecurity, irritability, restlessness, talkativeness, and sulkiness." In 1968, Wacker and Parisi reported that magnesium deficiency could cause depression, behavioral disturbances, headaches, muscle cramps, seizures, ataxia, psychosis, and irritability - all reversible with magnesium repletion.”[21]

May Require Supplementation
It has been estimated that 80 percent of people are deficient in magnesium. This is simply because the amount of magnesium in whole foods has become severely diminished due to conventional farming practices. Therefore, the majority of people could be considered deficient in the mineral.

Supplementation may be beneficial for those with heart disease, fibromyalgia, diabetes mellitus, osteoporosis, stress, and migraine headaches. Malabsorption such as celiac or Crohn’s disease, having surgery that affects the small intestines such as resection or bypass, aging, and alcoholism are high risk factors for magnesium deficiency.

It is important that magnesium supplements be taken in the morning and calcium at night because calcium enters the bones during the sleep cycle. Magnesium and calcium actually compete for absorption so they should not be taken simultaneously. When there is too much calcium at the cellular level the cells become rigid and appropriate detoxification cannot occur. With the addition of appropriate amounts of magnesium, the cells of the body become less rigid, and there is an overall anti-aging effect on the body.

Symptoms of Nutrient Deficiency
- Anxiety, Depression, Hyperactivity, Restlessness, Insomnia
- Chronic Fatigue
- Hormone Imbalance, PMS
- Fibromyalgia, Muscle (Leg) Cramps and Spasms, Restless Leg Syndrome (increase both magnesium & potassium)
- Weak Bones, Osteoporosis
- Constipation
- Diabetes II
- Tension or Migraine Headaches
- Increased Risk of Diabetes
- Chocolate & Sugar Cravings
- High Blood Pressure, Heart Disease

Food Sources
Salmon, spinach, chard, pumpkin seeds (pepitas), yogurt, goat cheese, kefir, almonds, cashews, peanuts, black beans, artichokes, avocado, figs, dark chocolate, banana, coriander.[22] Foods that are good magnesium sources are usually high in fiber.

Toxicity and/or Side Effects
Magnesium overdose (hypermagnesemia) is rare. It is most often seen in those with impaired kidney function after they have ingested pharmaceuticals (including antacids or laxatives) that contain magnesium. Symptoms may present as: irregular heartbeat, low blood pressure, respiratory distress, cardiac arrest, muscle weakness, lethargy, nausea and vomiting. Magnesium is a natural laxative, so a mild excess of it can result in diarrhea.

“Some medications for high blood pressure work by blocking calcium from entering cells. These medications are called calcium channel blockers. Magnesium might also block calcium from entering cells. Taking magnesium with these medications might cause blood pressure to go too low.” “Magnesium might slow blood clotting. Taking magnesium along with medications that also slow clotting might increase the chances of bruising and bleeding.”

Phosphorus (P)

Function
Phosphorus is involved in bone mineralization and hundreds of cellular activities as it is found in every cell of the body. It is also a part of the proper functioning and health of the brain, heart, kidneys, and liver. Found in every cell, it helps red blood cells release oxygen at the proper time. Phosphorus is integral in the system that maintains the acid-base balance and is a catalyst to boost energy. It balances hormones naturally and utilizes nutrients from food intake. About 85% of the body's phosphorus is stored in bones and teeth.

Deficiencies in phosphorus are unusual since it is easily absorbed by the small intestine, is abundant in many whole foods, and also added to many packaged foods as a synthetic ingredient. It is also easily absorbed by the small intestine.

~ ATP (Adenosine Triphosphate)

"ATP is an abbreviation for *adenosine triphosphate*, a complex molecule that contains the nucleoside *adenosine* and a tail consisting of **three phosphates**. As far as is known, all organisms from the simplest bacteria to humans use ATP as their primary energy currency. The energy level it carries is just the right amount for most biological reactions. Nutrients contain energy in low-energy covalent bonds which are not very useful to do most of kinds of work in the cells.

These low energy bonds must be translated to high energy bonds, and this is a role of ATP. A steady supply of ATP is so critical that a poison which attacks any of the proteins used in ATP production kills the organism in minutes. Certain cyanide compounds, for example, are poisonous because they bind to the copper atom in cytochrome oxidase. This binding blocks the electron transport system in the mitochondria where ATP manufacture occurs."

(Jerry Bergman, Ph.D.ATP: The Perfect Energy Currency for the Cell. Vol. 36, No. 1 of the *Creation Research Society Quarterly)*

May Require Supplementation
Anyone on a starvation or low-protein diet are more likely to become deficient in phosphorus than those on a high protein (especially animal protein) diet because animal proteins make phosphorus easier to absorb.

"The group most likely to experience phosphorus deficiency are older women. Ten percent to 15 percent of older women have phosphorus intakes of less than 70 percent of the recommended daily allowance. One reason this may be true is because older women are most likely to take high-dose calcium supplements (to address a calcium deficiency) that consist of the carbonate or citrate salts that bind to phosphorus and make it unavailable for absorption."[23]

Symptoms of Nutrient Deficiency

- Stunted Growth, Development Problems, Tooth Decay
- Osteoporosis (may be asymptomatic until a break occurs)
- Osteomalacia (combined with deficiencies in vitamin C & D): General Aches, Pains, and Bone Tenderness
- Fatigue, Weakness, Confusion, Difficulty Concentrating
- Loss of Appetite
- Muscle Weakness, Low Exercise Tolerance, Increased Risk of Injury
- Numbness in the Extremities
- Weight Loss/Gain

Food Sources

Pumpkin and Squash Seeds (Pepitas), Romano Cheese, Salmon, Sardines, Tuna, Shrimp, Scallops, Brazil Nuts, Pine Nuts, Almonds, Cashews, Pistachios, Pork, Beef, and Dairy.

Toxicity and/or Side Effects

Phosphorus is not easy to overdose since the kidneys in healthy people can simply excrete the excess. Yet, in those with chronic kidney disease (CKD) or end-stage renal disease, too much phosphorus can lead to hyperphosphatemia as can those with very low parathyroid hormone levels. Phosphorus can hinder the synthesis of the active metabolite of vitamin D and disrupt calcium absorption when ingested at very high levels. Also, high-level phosphorus consumption may lead to heart complications as the resulting mineral imbalance may affect blood pressure, circulation, and kidney function.

"Normal working kidneys can remove extra phosphorus in your blood. When you have chronic kidney disease (CKD), your kidneys cannot remove phosphorus very well. High phosphorus levels can cause damage to your body. Extra phosphorus causes body changes that pull calcium out of your bones, making them weak. High phosphorus and calcium levels also lead to dangerous calcium deposits in blood vessels, lungs, eyes, and heart. Phosphorus and calcium control are very important for your overall health…

Phosphorus that has been added to food in the form of an additive or preservative (inorganic phosphorus) is found in foods such as fast foods, ready-to-eat foods, canned and bottled beverages, enhanced meats, and in most processed foods. **Phosphorus from food additives is completely absorbed…** Phosphorus additives that are found in foods include: Dicalcium phosphate, Disodium phosphate, Monosodium phosphate, Phosphoric acid, Sodium hexameta-phosphate, Trisodium phosphate, Sodium tripolyphosphate, Tetrasodium pyrophosphate"

(The National Kidney Foundation: https://www.kidney.org/atoz/content/phosphorus)

Potassium (K)

An electrolyte is a substance that becomes electrically-charged ions in solution. Common electrolytes are sodium, potassium, calcium, magnesium, chloride, phosphates, and bicarbonate. Any process within the body that communicates by electrical signals is affected by the proper intracellular movement of electrolytes in the fluids. Nerve transmission, the brain, and the muscular system all depend upon this “electronic” transmission.

Electrolytes are located in blood, plasma, and inter- and intra-cellular fluids. They exit the body in urine, feces, and perspiration. Imbalances can occur from kidney disease or illness when symptoms include vomiting, diarrhea, high fevers, and sweating, all of which promote a loss of electrolyte fluid. Malabsorption and poor diets (which are low in nutrients), hormonal imbalances, chemotherapy, some cancer treatment medications, certain pharmaceuticals, steroid hormones, antibiotics, and diuretics affect the electrolyte balance within the body, a primary one being potassium.

Function
Integral to every cell in the body, potassium is necessary to stabilize blood pressure, regulate the heart and other muscle functions, facilitate proper nerve function, and increase bone density while reducing the elimination of calcium. It concentration is much higher within the cell than from without. In its antagonistic relationship to sodium which is in solution outside the cell, movement of nutrient-containing fluid both into and out of the cell is created. This movement which is powered by the hydrolysis of Adenosine triphosphate (ATP) that stores energy as it is converted to Adenosine diphosphate (ADP)[24] is the basis of the body’s resting metabolic rate (RMR).

Another very important benefit of potassium that cannot be overlooked is that it initiates the pumping of the heart which moves blood throughout the body. Again, we find that theme of movement with potassium. “A diet high in potassium has such effects as reducing the risk of heart disease, lowering the risk of cancer, and decreasing the risk of obesity. Additionally, potassium is used to treat specific conditions. Eye dryness, gout, lupus, high cholesterol, stroke, and heart disease can all be treated and prevented using potassium.”[25]

May Require Supplementation
Those who use diuretics risk lowering the potassium levels in the body (along with other important electrolytes.) There are many medications that affect potassium levels in the body and have the ability to make it either too high or too low. Herbs such as horsetail, bearberry (uva ursi), and parsley can remove potassium from the kidneys thereby reducing potassium levels in the body. Licorice also contains glycyrrhizin which has the ability to lower potassium levels and cause irregular heartbeat in certain people.

Symptoms of Nutrient Deficiency (Hypokalemia)

- Fatigue
- Heart Palpitations
- High Blood Pressure
- Irritability
- Muscle Cramping, Weakness & Pain
- Paralysis-like Sensation (in severe cases)
- Weight Gain, Increased Cellulite

Food Sources

Clams, spinach, potato (with skin), sweet potato, acorn squash, white beans, peas, carrots, tomatoes, mushrooms, coconut water, kefir, yogurt, avocado, dried apricots, apples, oranges, and bananas

Toxicity and/or Side Effects

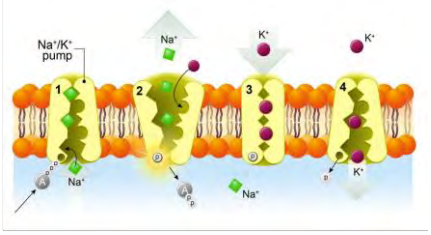
The most common side effects of the over-supplementation of potassium, called hyperkalemia, are generally gastrointestinal. They present as nausea, vomiting, abdominal discomfort, diarrhea and ulcers. Other symptoms may include fatigue, tingling sensations in the hands and the feet, or muscle weakness. The most serious symptoms may include slow heartbeat and weak pulse which can result in a cardiac arrest.

"Those with kidney disease should not take potassium supplements. Others who should refrain are 'those who are taking digoxin, ibuprofen, or naproxen, or potassium-depleting diuretics (such as Lasix and thiazide diuretics), and cisplatin (chemotherapy drug.)"[26]

Sodium (NA)

Function
Sodium has a positive electrical charge. It works together with other electrolytes to offer balance and proper movement to fluids at the cellular level including the transfer of nutrients into cells. Certain enzymes are dependent upon sodium for proper "carbohydrate digestion, to break down complex carbohydrates and sugars into monosaccharides such as glucose, fructose and galactose; sodium is also involved in transporting these monosaccharides across the intestinal wall."[27]

Along with chloride, sodium regulates the volume of water in the body. The kidneys are alerted as to what nutrients, waste, or excess water they must filter. In a dehydrated state or mineral deficient state, the kidneys work overtime to retain water and nutrients that are critical for homeostasis. In this way, blood fluid volume can affect blood pressure.



Sodium and potassium generate energy inside the cells of the body. Pure water itself does not conduct electricity, rather, it is electrolytes such as sodium and potassium (among others) that dissolve in water and assist in carrying an electrical charge.[28] Neurons use these ions, especially sodium and potassium ions in nerve signaling and in muscle contractions.

May Require Supplementation
"Conditions such as overhydration, burns, diarrhea and vomiting may cause sodium levels to drop below normal, a condition called hyponatremia. The decreased sodium levels in the blood cause fluid to move into tissue cells."[29] Other considerations for increased supplementation would be those who have with liver or kidney disease, and those with congestive heart failure.

"Age may also play a role in the severity of symptoms associated with low sodium levels. Older individuals may experience more severe symptoms than a younger person with the same sodium levels. General health also plays a role in symptoms because an aged, chronically ill person tends to develop more severe symptoms than a healthy, young person".[30]

"Sally Fallon Morell, president of the Weston A. Price Foundation, stated: 'A study from 1991 indicates that people need about one and one-half teaspoons of salt per day. Anything less triggers a cascade of hormones to recuperate sodium from the waste stream, hormones that make people vulnerable to heart disease and kidney problems. This is proven biochemistry."[31]

Symptoms of Nutrient Deficiency (Hyponatremia)
- High Blood Pressure
- Gastrointestinal Distress: Decreased Appetite, Nausea, Vomiting
- Headache, Irritability, Hallucinations
- Cognitive Impairment, Confusion
- Fatigue, Lethargy, Weakness
- Muscle Spasms, Muscle Cramps
- Seizures, Coma

Food Sources
Salt, milk, cheese, and cured meats. Fresh fruits, vegetables, and nuts have very little sodium unless it is added.

Toxicity and/or Side Effects
The effect of too much sodium in the blood is called hypernatremia. Some causes are dehydration due to decreased ingestion of water, or because of prolonged diarrhea and/or vomiting, kidney disease, or use of diuretics. The effects of hypernatremia can be edema, especially in those with kidney disease or damage, congestive heart failure, cirrhosis of the liver, or high blood pressure. Symptoms may appear like impaired thirst sensation, fever (which dehydrates the body), decreased appetite, nausea, diarrhea, vomiting, and abdominal pain.

Sulfur (S)

Function
Sulfur is known as 'the healing mineral. The greatest concentration in the body is found in the in the muscles, skin, and bones. It is also found in keratin, that hard substance that gives strength to hair and nails. Cartilage and connective tissue are made from more flexible sulfur bonds. As one ages stiff muscles, painful joints, and sagging and wrinkling skin are due to a loss of sulfur.[36]

Sulfur is also important to the cellular production of energy, proper insulin function, detoxification, and along with vitamins B-1 and B-7 in converting carbohydrates into energy. It is necessary for the proper structure and function of enzymes and also helps create glutathione (a 'master ' antioxidant) in the body. Glutathione is present in every cell of the body and recharges other antioxidants, but is not absorbed well by the body when taken orally.[37]

Sulfur has been shown to lower blood levels of cholesterol and triglycerides, as well as improve cell membrane function in red blood cells. It increases bone density and is of benefit to menopausal women who experience a loss of bone density thereby, lowering the risk of hip fracture through "an onion a day".

Onion's sulfur compounds may work in an anti-clotting capacity and help prevent the unwanted clumping together of blood platelet cells. Sulfur is anti-inflammatory and inhibits the activity of macrophages, it has an antiparasitic effect and normalizes the immune system making it beneficial for autoimmune diseases like rheumatoid arthritis and lupus.[38] It also enables the transport of oxygen across cell membranes and is responsible for healthy cell regeneration. Muscle tissue itself is made up of protein, mineral, and organic sulfur.

May Require Supplementation
Those who are in a malnourished state such as the aging, the infirm, the obese, and people who eat a majority of highly processed foods or have a diet high in breads and cereals can benefit from supplementation.

Vegans and vegetarians are at risk for developing a sulfur deficiency since "meat and fish are considered 'complete 'as they contain all the sulfur-containing amino acids you need to produce new protein."[39] It is a myth that "soy foods provide complete protein. Like all legumes, soybeans are deficient in sulfur-containing amino acids methionine and cysteine, In addition, modern processing denatures fragile lysine."[40]

Symptoms of Nutrient Deficiency
- Allergies
- Arthritis
- Chronic Inflammation
- Degenerative Diseases, Alzheimer's, Parkinson's
- Diabetes
- Depression, Sensitivity to Physical and Psychological Stress
- Loose Teeth, Plaque Buildup, Gum Disease

- Wrinkling Skin
- Cardiovascular Health
- Chronic Back, Neck & Body Pain (from muscles not being able to repair themselves)

Food Sources of Sulfur
Raw milk, raw cheese, pastured eggs, fish, poultry, meats, nuts, legumes, garlic, onion, asparagus, broccoli, cauliflower, cabbage, kale, Brussels sprouts, turnips, bok choy and kohlrabi. Additional sources of sulfur include soaking in a warm bath of about ½-1 cup of Epsom Salts and/or MSM supplementation.

Toxicity and/or Side Effects
Individuals with medical conditions such as ulcerative colitis may experience an increase in symptoms after eating foods high in sulfur because of an inability to breakdown the mineral correctly.

There are two types of sulfur, organic and inorganic. Sulfur is an element known as sulfur oxide which when ingested is then processed into sulfuric acid. This form of sulfur is toxic and cannot be absorbed or digested. It is also very irritating to the skin and the digestive system. Nontoxic "Methylsulphonylmethane (MSM) is an organic sulfur compound found in all living plant and animal tissues. It is a white, odorless, crystalline powder. This form of sulfur is 100% organic, and is actually extremely beneficial to the human body. Unlike sulfur oxide, organic sulfur is a food grade form of sulfur that is absolutely necessary for proper health."[41]

MICROMINERALS / TRACE MINERALS

Boron (B)

Function
The highest concentrations of boron are found in the parathyroid glands, heart, spleen, and bones.[76] Well-known for its balancing effects on steroid hormones and for its ability to reduce inflammation, boron reduces the reactive oxygen generated during the course of converting food to energy which enhances antioxidant defenses and aids the immune system, potentially reducing risk for autoimmune diseases. It also reduces the amount of insulin required to maintain proper glucose levels and slows the absorption of glucose in the intestines. Boron also contains powerful enzyme inhibitors and substances that promote cardiovascular function and reduce cholesterol levels.

Historically, Native Americans practiced making an infusion of the herb borage to help decrease arthritis pain. We know now that borage has significant amounts of the trace mineral boron in its makeup and may actually avert deterioration of the joints and arthritis pain due to boron's role in bringing calcium into cartilage. Similarly, boron directs calcium into bones, making them denser.

A diet low in boron may worsen deficiencies in both vitamin D and magnesium or any condition in which these minerals are lost in urine. Studies show boron can assist the body in its production and use of vitamin D. When both boron and magnesium are not adequate in the body, calcium is excreted through urine and collects in the kidneys forming stones.

Boron 'wakes up 'the brain, increasing cognition and may cause sleeplessness if taken before bed time. Manual dexterity, eye-hand coordination, attention, perception, encoding and short-term and long-term memory show improvement with boron.[67] It is also key in assisting with the hydroxylation and balancing of steroid hormones, which include lowering estrogen and increasing testosterone. Menopausal symptoms and psoriasis are notably reduced, allergies improved, blood clots prevented, and Candida albicans, arthritis, osteoarthritis, rapid-aging, and lupus are all positively affected.

May Require Supplementation
Boron supplementation may benefit those who suffer from allergies, arthritis, osteoporosis, who have broken bones (both preventative and in recovery), with hormonal and metabolic issues including blood glucose and abnormal calcium and magnesium metabolism, kidney stones, Diabetes I or II, and low testosterone or high estrogen issues. Bodybuilders wanting to build muscle mass find boron helpful as well as it assists in exercise recovery.

Symptoms of Nutrient Deficiency
- Abnormal Bone Growth & Development
- Lessening in Height Due to Aging
- Hyperthyroidism
- Steroid Hormone Imbalance (testosterone/estrogen)
- Fertility/Prostate Issues, Birth Defects
- Osteoporosis, Arthritis
- Skin Infections/Redness/Inflammation/Pain
- Yeast Infections
- Short & Long-term Memory Loss, Neural Malfunction

Food Sources
Raw unpasteurized milk, red wine, apples, beans, potatoes, sweet potatoes, onions, artichokes, avocado, grapes, oranges, apples, berries/cherries, figs, prunes/plums, peaches, apricots, pears, raisins, gelatin, cocoa, pecans, walnuts, almonds, Brazil nuts, and honey.

Toxicity and/or Side Effects
"Boron toxicity isn't a risk when consuming whole foods, but taking high doses of supplements can potentially become dangerous and cause reactions like nausea, gastric discomfort, vomiting, diarrhea**,** skin problems, heart palpitations, anxiety and depression."[68] Adults can safely consume from 30 to 75 mgs. of boron per day. However, in young women of child-bearing age, due to the potential of toxicity to a developing fetus, boron supplementation should be limited to not more than 30 mg per day.[69]

Chromium (Cr)

Function
Trivalent (Chromium 3+) is the biologically active form of chromium sourced in food that is utilized as a nutritional trace mineral. Chromium, directly as well as indirectly influences the hormone insulin in the metabolism and storage of carbohydrates, fats, and proteins. It is important in regulating blood sugar by causing the energy flow to remain stable. Vitamin B-3 (Niacin) and vitamin C work to enhance chromium's absorption and storage in the liver, spleen, soft tissue, and bone.[72]

May Require Supplementation
"Chromium deficiency causes insulin resistance, and supplementation with adequate chromium overcomes that resistance. … In a four-month, double-blind study carried out in China, 180 people with Type II diabetes were given twice-daily doses of either placebo, 100 mcg chromium picolinate or 500 mcg chromium picolinate. In measurements at two and four months, the group with the daily intake of 1,000 mcg chromium showed consistent improvement in biochemical indicators. They had significant reductions in blood-glucose and insulin concentrations two hours after a glucose load, fasting glucose and fasting insulin (measurements taken long after a meal, typically first thing in the morning), and glycosylated hemoglobin (a marker of long-term glucose control; lower is better). At 200 mcg per day, there was no improvement in fasting or two-hour glucose, but fasting and two-hour insulin decreased as much as with 1,000 mcg chromium picolinate per day. Glycosylated hemoglobin also fell, but less than with 1,000 mcg chromium picolinate daily. Thus, chromium—particularly the higher dosage—favorably affected biochemical indicators of diabetes."[73]

"The body's chromium content may be reduced under several conditions. Diets high in simple sugars (comprising more than 35% of calories) can increase chromium excretion in the urine. Infection, acute exercise, pregnancy and lactation, and stressful states (such as physical trauma) increase chromium losses and can lead to deficiency, especially if chromium intakes are already low."[74]

Antacids, corticosteroids, H2 blockers, and proton-pump inhibitors alter stomach acidity and may either impair the absorption of or enhance chromium's excretion. Conversely beta-blockers, corticosteroids, insulin, nicotinic acid, NSAIDS, and prostaglandin inhibitors taken with chromium may result in increased potency of the medication or availability of chromium.[75]

Symptoms of Nutrient Deficiency
- Insulin Resistance
- Diabetes Mellitus
- High Cholesterol

Food Sources
Meat, fish, green beans, broccoli, oranges, apples, grape juice, red wine, potatoes, garlic, basil. (Note that foods high in fructose and sucrose are low in chromium.)

Toxicity and/or Side Effects
Trivalent chromium does not appear to be toxic to humans.

Cobalt (Co)

Function
Cobalt is an essential trace mineral utilized by the body, not in its ionic "metal" form, rather as a "metallovitamin", a part of vitamin B-12. Not easily assimilated within the body, cobalt must first pass through the stomach and be reduced to a component of B-12 by the action of hydrochloric acid. The liver stores most of the body's cobalt, however, it can also be found in red blood cells, plasma, the spleen, the kidneys, and the pancreas.

Cobalt is essential for a normal-functioning pancreas, hemoglobin formation, and for healthy red blood cells as it is key in iron absorption. Also, it is believed to aid in the repair of the nerve-protecting myelin covering. In DNA synthesis, cobalt stimulates and regulates some co-enzyme generation and plays a role in gene expression as a part of vitamin B-12. Cobalt may assist in treating anemia that does not respond to other treatment.

Cobalt is a necessary cofactor for making the thyroid hormone thyroxine. A 2014 study on endemic goiter in Iran established that cobalt deficiency "lead to symptoms of goiter in school-aged children. Even decades after iodine deficiency control program was initiated in 1989 by iodizing salt, the incidence of goiter has remained an endemic condition in most parts of Iran. Studies revealed that goitrous children when compared to non-goitrous children, had lower serum cobalt levels. The authors concluded that, "cobalt deficiency may be an important independent predictor for goiter in endemic regions, especially areas in which goiters persist despite salt iodization programs. 'The cobalt deficiency and its symptoms are treated by vitamin B12 replacement therapy."[76]

Cobalt in the form of B-12 is obtainable from micro-organisms or from animal sources. Vegetable sources of cobalt are significant to ruminants (sheep and cattle). Cobalt deficiency in humans is similar to a vitamin B-12 deficiency, with anemia.

May Require Supplementation
Due to vitamin B-12 and cobalt being primarily found in meat, vegetarians and vegans are more likely to exhibit cobalt and/or vitamin B-12 deficiency than carnivores.

Symptoms of Nutrient Deficiency
- Pernicious Anemia
- Nerve Disorders
- Abnormal Cell Formation
- Scaly Skin
- Atrophy
- Shortness of Breath
- Low Thyroid Function

Food Sources
Beet greens, cabbage, figs, goldenseal, Irish moss, lettuce, mushroom, pau d'Arco, sarsaparilla, spinach watercress, sea vegetables, and green leafy vegetables.

Toxicity and/or Side Effects
Cobalt used to stabilize beer froth was found to have a toxic effect on the heart. Its toxicity (at about 8000 micrograms per day) probably arose from its interaction with alcohol, and the nutritional problems created by alcohol. When utilized as a form of B-12, cobalt is non-toxic.

Copper (Cu)

Function
Copper is an antioxidant that is necessary in many enzyme reactions and for iron and oxygen metabolism. It contributes to the growth of the body and its ability to repair itself. Together with zinc, potassium and calcium, copper balances the activity of the thyroid. Copper aids cognition and stimulates the brain. It is thought to be beneficial when used in neurodegenerative disorders like Alzheimer's or Parkinson's as it supports the nervous system by protecting the myelin sheath.

Copper is able to repair connective tissue by helping in the process of building collagen and elastin. It has anti-inflammatory properties that reduce arthritic and joint pain and stiffness. It creates the pigment and texture of the skin, hair and eyes. "Copper aids iron absorption and the transport of iron to bone marrow for red blood cell formation. Without enough copper, iron accumulates in the liver, heart, endocrine, and reproductive glands. Continued accumulation in these organs can lead to liver failure, heart muscle deterioration, arthritis, and hormonal imbalances."[51]

"High serum levels of copper exist when the body suffers from disease. This elevation of copper is a natural response to the stress response."[52] By eliminating the cause of the stress the body will correct itself. By simply lessening the intake of copper as is generally practiced in allopathic medicine, the body's ability to achieve homeostasis is hindered.

May Require Supplementation
Those who suffer from chronic malabsorption disorders like Crohn's disease may benefit from supplementation. Copper absorption may be obstructed due to excessive supplementation of iron or zinc and by nutrients like vitamin C. Irritable Bowel Disease (IBD) and reduced digestive function associated with aging also interfere with proper copper absorption. Bariatric surgery causes many nutrient deficiencies and copper is frequently affected.

Symptoms of Nutrient Deficiency
- Arthritis, Brittle Bones, Joint & Muscle Soreness & Pain
- Anemia, Low White Blood Cell Counts, Fatigue, Low Energy
- Low Body Temperature (always feeling cold)
- Skin Inflammation/Loss of Pigmentation, Sores, Bruising
- Sluggish Metabolism, Irregular Heartbeat, Frequent Illness
- Hormonal Imbalances, Hair Thinning or Balding
- Neural & Nervous System Dysfunction (that appears as a Vitamin B-12 deficiency)

Food Sources
Liver, oysters, wild seafood, fish, cashews, almonds, chickpeas, quinoa, sesame seeds, chia seeds, beans, lentils, goat cheese, shitake mushrooms, avocado, kale, dark leafy greens, raisins, prunes, and cocoa powder.

Toxicity and/or Side Effects
Bioavailable copper is easily flushed out of the body through the bile and does not pose as a health concern, however, copper poisoning can occur from free copper. Free copper is metallic copper in its unbound form originating from corroded pipes and copper or cast-iron cookware. Copper toxicity presents as nausea, vomiting, diarrhea, kidney damage, or anemia.

Fluoride (F-)

Fluoride, in very low amounts (mcg/microgram amounts), is naturally found in fresh surface water and a variety of fresh fruits and vegetables. There are 1,000 mcg in a milligram. “Fluoride is added to public water supplies at an average concentration of about 1 part per million (1 ppm) or **1 milligram per liter**, or slightly below. Naturally occurring fluoride concentrations in surface waters depend on location but are generally low and usually do not exceed 0.3 ppm.”

Toxicity and/or Side Effects
We have all heard that fluoride is beneficial for healthy bones and teeth and in the name of “health” it has been added to the majority of the public water supply across the U.S. Unfortunately, what is actually added a combination of Hexaflorosilicic Acid and Sodium Silicoflouride which are off-gassed in the production of phosphate fertilizer. Both of these substances are considered toxic by the EPA and are required to be handled as hazardous waste, while neither of them is bioavailable to the human body.

“Fluoride accumulates in the body**.** Healthy adult kidneys excrete 50 to 60% of the fluoride ingested each day (Marier & Rose 1971). The remainder accumulates in the body, largely in calcifying tissues such as the bones and pineal gland (Luke 1997, 2001). Infants and children excrete less fluoride from their kidneys and take up to 80% of ingested fluoride into their bones (Ekstrand 1994). The fluoride concentration in bone steadily increases over a lifetime (NRC 2006).”[53]

Popularly heralded as crucial in the formation of bones and teeth and necessary to thwart cavities, Fluoride is not even an essential nutrient. “No disease, not even tooth decay, is caused by a “fluoride deficiency.”(NRC 1993; Institute of Medicine 1997, NRC 2006). Not a single biological process has been shown to require fluoride. On the contrary there is extensive evidence that fluoride can interfere with many important biological processes. Fluoride interferes with numerous enzymes (Waldbott 1978). In combination with aluminum, fluoride interferes with G-proteins (Bigay 1985, 1987). Such interactions give aluminum-fluoride complexes the potential to interfere with signals from growth factors, hormones and neurotransmitters (Strunecka & Patocka 1999; Li 2003). More and more studies indicate that fluoride can interfere with biochemistry in fundamental ways (Barbier 2010).”[54]

Symptoms of Nutrient Toxicity
- Disruption of the Endocrine and Immune Systems
- Inhibited Formation of Antibodies
- Enzyme Inactivation and Inhibition
- Damaged Sperm & Increased Infertility
- Arthritis, Inhibition of Collagen Synthesis
- Muscle Disorders
- Stomach & Gastro Intestinal Tract problems, Headaches, Rashes
- Hyperactivity and/or Lethargy, Fatigue
- Fetal Brain Damage, Low IQs in Children, Brain Damage, Dementia, Impaired visual-spatial organization, Headaches
- Increased Lead Absorption
- Thyroid Disease, Lowered Thyroid Function (Hypothyroidism)
- Dental Fluorosis, Bone Fractures, Bone Cancer (Osteosarcoma)
- DNA Damage & Cell Death, Tumors, Cancers

"Fluoride toxicity is exacerbated by conditions that occur much more frequently in low-income areas. This includes: nutrient deficiencies, infant formula consumption, kidney disease, and diabetes. African American and Mexican American children have significantly higher rates of dental fluorosis, and many low-income urban communities also have severe oral health crises, despite decades of water fluoridation."[55]

Iodine (I)

Function
Iodine is a crucial mineral found in high amounts in the thyroid and breasts and also to a smaller degree in the prostate, salivary glands, skin, intestines, and red and white blood cells. It is important in both forms of thyroid hormones, which help regulate growth, development, and also metabolism which regulate the body's temperature, heart rate, glucose consumption, and blood lipid levels.

The therapeutic actions of iodine are antibacterial, anticancer, anti-parasitic, antiviral, elevates pH, and is mucolytic. Conditions that can be treated with Iodine are: "ADD/ADHD, atherosclerosis, breast diseases, Dupuytren's contracture, excess mucous production, fatigue, fibrocystic breasts, goiter, hemorrhoids, headaches and migraines (including menstrual migraines), hypertension, infections, keloids, liver diseases, nephrotic syndrome, ovarian disease, parotid duct stones, Peyronie's disease, prostate disorders, sebaceous cysts, thyroid disorders (hypothyroidism, autoimmune thyroid diseases such as Hashimoto's and Grave's disease, vaginal infections."[56]

"Selenium is a necessary co-factor for a family of enzymes called iodothyronine deiodinase. These enzymes are responsible for activation and deactivation of thyroid hormones. As such, deficiency of selenium may either exacerbate iodine deficiency, or even mimic some of the symptoms. We also know that deficiency of iron makes the thyroid dysfunction seen in iodine deficiency worse."[57]

May Require Supplementation
Certain diets may cause iodine deficiency such as those without ocean fish or sea vegetables, low-sodium diets, veganism and vegetarianism, and diets high in the consumption of bakery products. Iodine, being a halogen, is replaced by the toxic halogen bromide by the receptors in female breast/reproductive tissue when iodine is deficient. Bromine replaced iodine in flour products in the 1980s.[58] Fluoride is another toxic halogen that replaces iodine in the body making fluoridated water consumption a concern. Receptors in the brain seem to be especially vulnerable to this exchange. "Research has shown fluoride is much more toxic to the body when there is iodine deficiency present."[59]

Other areas of concern are cigarette smoking as tobacco smoke contains thiocyanates that interfere with Iodine uptake. Additionally, medications such as Lithium (for bipolar disorder) and phenylbutazone (an anti-inflammatory) inhibit Iodine absorption.

A goiter is the term used to described an enlarged thyroid. The thyroid enlarges to bring in more blood in an attempt to capture the iodine it is lacking. If you do not have enough iodine in your body, you cannot make enough thyroid hormone. The thyroid hormones thyroxine (T4) and triiodothyronine (T3) are produced by the thyroid gland. Each molecule of T4 and T3 is made up of a protein and iodine (T4 contains 4 molecules of iodide and T3 contains 3 molecules of iodide. During pregnancy, inadequate supplies of thyroid hormones and iodine may lead to mental retardation.

Symptoms of Nutrient Deficiency (Hypothyroidism)[60]

- Brittle Nails, Dry Skin, Hair Loss
- Cold Hands & Feet, Cold Intolerance
- Constipation
- Depression, Irritability, Nervousness, Inability to Concentrate, Poor Memory
- Cretinism (severe brain damage in early life), Mental Impairment, Reduced Intellect
- Difficulty Swallowing, Hoarseness, Throat Pain
- Elevated Cholesterol, Hypertension or Hypotension, Slower Heartbeat
- Eyelid Swelling, Puffy Eyes
- Infertility, Menstrual Irregularities
- Fatigue, Muscle Cramps/Weakness
- Risk of Cancer: Breast, Prostate, Endometrial, & Ovarian
- Neonatal Mortality, SIDS (Sudden Infant Death), Multiple Sclerosis, other Myelin disorders
- Weight Gain

Symptoms of Nutrient Excess (Hyperthyroidism-Autoimmune)

- Goiter
- Heat Intolerance, Sweating
- More Frequent Bowel Movements
- Rapid Heartbeat (tachycardia)
- Tremor
- Skin Thinning, Fine Brittle Hair
- Sudden Weight Loss
- Increased Appetite

Hyperthyroidism is caused by inflammation as the gland is under attack by an overactive immune system. Hypothyroidism occurs when the thyroid works to make more thyroid hormone without the required dietary iodine. In both cases, the thyroid gland swells creating a goiter. "…Patients with autoimmune thyroid disorders can fluctuate symptomatically between overactive thyroid symptoms (hyperthyroidism) and underactive thyroid symptoms (hypothyroidism). These patients can also suffer from a combination of hypo- and hyper-thyroid symptoms."[61]

Food Sources

Dried seaweed (esp. kelp, wakame, dulse), scallops, cod, shrimp, tuna, salmon, sardines, eggs, cow's milk, yogurt, turkey breast, navy beans, peanuts, potato with skin, sweet potato, onion, spinach, strawberries, cranberries, bananas, cantaloupe.

Toxicity and/or Side Effects

Excessive iodine intake can lead to mouth pain, nausea, and vomiting. Iodine allergy is rare; however, it can include rash, fatigue, congestion, headache, and fever.[62]

Iron (Fe)

Function
Iron has three primary functions in the human body. First, iron is needed to produce the protein molecule hemoglobin. Hemoglobin is found in the red blood cells and carries oxygen from the lungs to the tissues throughout the body. Secondly, iron is used to produce the protein myoglobin. Myoglobin captures the oxygen in skeletal muscle and in the heart so it may be used in the production of energy. Energy is required for muscle contractions. Lastly, iron is a necessary for the normal development of the immune system.

Anemia is a deficiency of healthy red blood cells or hemoglobin. There are three common types of anemia that occur during pregnancy: iron-deficient anemia, folate-deficient anemia, & vitamin B-12 deficient anemia. When giving birth, "…studies have found that delaying the clamping of the cord, and allowing blood to flow between the placenta and the child for at least one minute after birth, significantly raises the child's iron and hemoglobin level."[42] It is said to be best to wait until the cord stops pulsing.

May Require Supplementation
Pregnant women and women with very heavy menstrual bleeding or extended periods of vaginal bleeding are at risk of becoming deficient in iron. Infants who are preterm, low birthweight, or who have mothers who were anemic are also at risk. Supplementation is often required for, those who have cancer, gastrointestinal disorders (or surgery), or who have had heart failure. Inadequate nutrition, malabsorption, and those who use aspirin and oral anticoagulants may also require supplementation.

Symptoms of Nutrient Deficiency
- Mild to moderate iron-deficiency can be Asymptomatic
- Fatigue/Exhaustion, Dizziness, Lightheadedness
- Poor Concentration, Headache
- Frequent Infections
- Swollen Tongue
- Pale Skin, Brittle Nails, Hair Loss
- Restless Leg Syndrome
- Cold Hands & Feet
- Poor Appetite, Pica
- Tachycardia, Arrhythmia, Heart Murmur, Enlarged Heart, Heart Failure
- Shortness of Breath

Food Sources
There are two types of iron found in food. First, there is heme iron which is found in animal meat that originally contained hemoglobin. Meat sources are about 40% heme iron and 60% non-heme iron. Examples of heme iron are red meats, fish, and poultry. The body absorbs the most iron from heme sources. The most iron-rich are beef or chicken liver, clams, mollusks, mussels, and oysters. Good sources are beef, sardines canned in oil, and turkey.

Plant foods only contain non-heme iron which is derived mainly from cereals, legumes, fruits and vegetables. Examples of these are beetroot, beet greens, beans, pumpkin/sesame/ squash seeds, dried apricots, potato, broccoli, peanuts, pecans, walnuts, pistachios, roasted almonds/cashews, sunflower seeds, raisins, peaches, prunes, spinach, and green pepper.

“To improve your absorption of iron, eat it along with a good source of vitamin C -- such as orange juice, broccoli, or strawberries -- or eat non-heme iron foods with a food from the meat, fish, and poultry group.”[43]

Toxicity and/or Side Effects
Food-based iron toxicity is rare. However, iron poisoning from supplementation can pose a concern since most iron accumulates in body tissues and organs such as the liver, spleen, and in the marrow of the bones.

“The first indication of iron poisoning by ingestion is stomach pain, as iron is corrosive to the lining of the gastrointestinal tract, including the stomach. Nausea and vomiting are also common symptoms and bloody vomiting may occur. The pain then abates for 24 hours as the iron passes deeper into the body, resulting in metabolic acidosis, which in turn damages internal organs, particularly the brain and the liver. Iron poisoning can cause hypovolemic shock due to iron's potent ability to dilate the blood vessels. Death may occur from liver failure.”[44]

Manganese (Mn)

Function
Manganese can be found in cartilage, bones, liver, kidneys, pancreas, with lesser amounts in the adrenals, and pituitary glands. It is important for brain and nerve operation, and in regulating glucose metabolism, the development of connective tissue, blood clotting, and in sex hormones.

In antioxidant function, manganese is the main antioxidant enzyme found in the mitochondria. Additionally, it activates other enzymes significant in the metabolism of carbohydrates, amino acids, cholesterol, and those that create glucose from non-carbohydrate precursors, a process called gluconeogenesis. Manganese is necessary for the absorption of calcium into bones and cartilage for proper skeletal development. It is also crucial for the proper healing of wounds because it activates an enzyme which provides the amino acid proline, key in the formation of collagen.

May Require Supplementation
People with poor dietary intake, malabsorption, or who use antacids or oral contraceptives which interfere with the absorption of manganese may benefit from supplementation. Manganese is lost in perspiration; therefore, excessive sweating may reduce manganese levels in the body. Excess iron, copper, or magnesium are known to deplete manganese. Chronic liver or gallbladder disorders will increase the body's need for magnesium.

Additionally, foods that contain phytic acid (beans, nuts, seeds and whole grains) or food high in oxalic acid (sweet potatoes and cabbage), could moderately inhibit absorption. However, cooking could neutralize this effect. Other minerals such as phosphorus, calcium, and iron restrict the ability of the body to retain manganese.

Symptoms of Nutrient Deficiency
- Infertility
- Paralysis in Infants
- Abnormal Bone Development, Impaired Growth
- Altered Carbohydrate & Lipid Metabolism
- Impaired Glucose Tolerance
- Abnormal Wound Healing
- Dizziness, Seizures, Convulsions
- Weakness, Nausea, Vomiting
- Iron-deficiency Anemia
- Weak Hair & Nails
- Blindness
- Hearing Loss

Food Sources
Egg yolks, brown rice, oatmeal, quinoa, dark leafy greens, beets, sweet potatoes, celery, squash, carrots, pineapple, grapes, kiwi, berries, almonds, pecans, peanuts, seeds, peppermint, cinnamon, and thyme.

Toxicity and/or Side Effects
"Manganese rarely causes side effects when taken orally. It can be toxic to people who regularly inhale manganese vapors, such as industrial workers in steel mills and mines, or people with liver damage, including alcoholic cirrhosis. Symptoms include loss of appetite, headaches, leg cramps, muscle rigidity, tremors, convulsions, extreme irritability, acts of violence, and hallucinations."[45]

Manganese that has been inhaled is transported to the brain without being metabolized by the liver (as is ingested manganese.) "Manganese is ordinarily eliminated from the body through bile, but cirrhosis and portosystemic shunts impair the normal functioning of the liver and thus limit the ability of the body to excrete manganese, which then can accumulate in the blood and, eventually, the brain."[46]

People with greater vulnerability to manganese toxicity would be those with chronic liver disease (since manganese is excreted in the bile), newborns (because they have a greater amount of receptor in developing nerve cells and an immature bile elimination system), children (as they have higher intestinal absorption of the mineral and limited bile excretion), and iron-deficient people (as a lack of iron is relative to a likely accumulation of manganese in the brain.)

Supplements with manganese should be spaced one hour before or two hours after antacid, laxative, Reserpine (for high blood pressure), or Tetracycline/Minocycline/Demeclocycline antibiotic use as the drugs will inhibit the absorption of manganese. Conversely, manganese may inhibit the body's absorption of Quinolone antibiotics without a similarly spaced margin of time before or after. Due to the potential for negative interaction, manganese should not be supplemented in conjunction with Haloperidol and other antipsychotics.

Molybdenum (Mo)

Function
Recognized as an essential trace mineral, molybdenum is crucial to normal cellular function and producing energy at the cellular level. It plays and important role in carbohydrate metabolism, the utilization of iron, sulfite detoxification, and uric acid formation. It also supports the production of red blood cells along with vitamin B-2 to assimilate iron into hemoglobin. While molybdenum is needed in only minute quantities, it is necessary for optimal health. Found in the bones, liver and kidneys, molybdenum boosts the function of the nervous system and kidneys, allows the body to use nitrogen and may help counteract the damaging effects of certain cancer drugs on the heart and lungs.

"The molybdenum content of foods depends on the molybdenum content of soils, which can vary considerably. Variation in esophageal cancer incidence worldwide has been linked to the molybdenum content in soils and food. Similar observations have been made in order to identify the factors associated with a population's extended lifespan."[63]

May Require Supplementation
Those whose "genetic condition interferes with their absorption of molybdenum [such as such as Inherited Molybdenum Cofactor Deficiency], or who receive nutrition on prolonged intravenous feeding, may be at risk for molybdenum deficiency."[64] Others at risk would be people who struggle with anorexia, bulimia, and any whose diets primarily consist of processed foods (processed with sulfites for longer shelf-life.) Those with Esophageal cancer, Crohn's, and other malnourished states, should be considered for supplementation. Molybdenum may also be considered quell sulfite sensitive asthma and allergies.

Symptoms of Nutrient Deficiency
- Increased Respiratory/Heart Rate
- Sexual Impotence in Older Males
- Esophageal Cancer
- Disorders of the Mouth/Gums
- Wilson's Disease
- Sulfite Sensitivity

Food Sources
Liver, garbanzo beans (chickpeas), pinto beans, lentils, peas, brown rice, millet, whole grains, dark green leafy vegetables, nuts.

Toxicity and/or Side Effects
Molybdenum is generally considered safe, however, excessive intake of more than 10mg over a long period has been linked to pain and swelling of joints. Other symptoms of high molybdenum intake include dizziness, tiredness, and rashes. Excessive ingestion of molybdenum can prevent the absorption of copper and block the activity of copper-dependent enzymes[65] causing low red (anemia) or white blood cell counts.

Selenium (Se)

Function
Selenium is an important mineral that also serves as an antioxidant. Selenium boosts the production of white blood cells which are necessary for proper immune function, is required for healthy sperm and normal testicular development, and it is vital in the metabolism of thyroid hormone.

"Recent evidence on the role of selenium and selenoproteins in the production of lipid mediators…involved in inflammatory responses suggests that selenium supplementation might mitigate dysfunctional inflammatory responses that contribute to the pathogenesis of many chronic health conditions"[47] such as asthma and IBS.

May Require Supplementation
Those who eat a highly processed diet may not get enough selenium because it is destroyed when foods are refined or processed. Other issues that may create selenium deficiencies are cigarette smoking, alcohol, birth control pills, malabsorption issues such as Crohn's disease or ulcerative colitis and enteral or parenteral feeding. Some medical diets used to treat phenylketonuria, homocystinuria, and maple syrup urine disease should be supplemented for best results in selenium status.

Possible drug interactions that may lower selenium include: Cisplatin (a chemotherapy drug), Clozapine (Clozaril), Corticosteroids, such as prednisone, and Valproic acid (Depakote)

Symptoms of Nutrient Deficiency
- Muscle Weakness & Muscle Wasting
- Congestive Heart Failure
- Worsening of Atherosclerosis (increases risk of Heart Attack or Stroke)
- Male Infertility; Cancer; Asthma; IBS
- Rheumatoid Arthritis (although supplementation does not appear to reverse)
- Keshan Disease, Kaschin-beck Disease, Cretinism (low iodine & selenium)

Food Sources
Brewer's yeast, wheat germ, liver, butter, fish, shellfish, garlic, sunflower seeds, Brazil nuts.

Toxicity and/or Side Effects
High levels of selenium may negatively impact sperm motility. It can also increase the risk of diabetes and high cholesterol. High doses taken over a long period of time can have toxic side effects such as: nail dystrophy, skin rash, fatigue, irritability, and weight loss. Selenium should not be supplemented for those who have had or are at risk for skin cancer or have an underactive thyroid. Selenium supplements may increase the risk of bleeding when taken alongside anticoagulants and blood thinners such as: Clopidogrel (Plavix), Warfarin (Coumadin), Heparin, and Aspirin. Selenium supplementation may also increase the length of the sedative effects of barbiturates.

Vanadium (V)

Function
Limited research has been accomplished regarding vanadium's role in the body as an essential trace mineral. What is known is that vanadium appears to influence the structural formation of bones & teeth, but currently, it is not known how. "Since 1985, studies with goats and rats apparently have found true responses to low intakes of vanadium. Responses of goats fed a vanadium-deficient diet included skeletal deformations and death within 90 days of birth."[70]

Vanadium is also suspected to play a role in hormone and carbohydrate metabolism. "In rats, vanadium deprivation affected changes in thyroid weight and plasma thyroxine and triiodothyronine concentrations caused by feeding deficient or luxuriant iodine. Vanadium deprivation also depressed the activity of pancreatic amylase, and affected serum lactate dehydrogenase in an opposite manner when dietary iodine was deficient than when it was luxuriant. These findings indicate physiological amounts of vanadium affect thyroid hormone and carbohydrate metabolism, and when combined with the knowledge that homeostatic mechanisms exist for vanadium, and that vanadium has functional roles in lower forms of life, provide circumstantial evidence that vanadium is an essential element for higher forms of life. A daily dietary intake of 10 µg of vanadium probably will meet any postulated vanadium requirements of humans."[71] The most biologically available forms of vanadium are either vanadyl or vanadate.

May Require Supplementation
According to a very small amount of human studies, vanadium appears to stimulate glucose uptake, and encourage cell response by activating enzymes that then sensitize the cells response to insulin. This is good news for diabetics.

Symptoms of Nutrient Deficiency
- Possible Unstable Blood Glucose
- Possible Sugar Cravings
- Possible Elevated Cholesterol

Food Sources
Seafood, buckwheat, oats, whole wheat, sunflower seeds/oil, olive oil, corn, green beans, peanut oil, carrots, cabbage, tomatoes, lettuce, parsley, dill, garlic, radishes, onions, beets, apples, plums, mushrooms, gelatin

Toxicity and/or Side Effects
Excessive levels of vanadium may present the, bleeding of livers and kidneys, cardiac and vascular disease, damage to the nervous system, inflammation of the stomach and intestines, nose bleeds, throat pains, severe trembling and paralyses, skin rashes, behavioral changes, and manic depression.

Zinc (Zn)

Function
Zinc stimulates the activity of 100 different enzymes and is involved in cellular metabolism, cellular proliferation, differentiation, and cell death. It is a crucial nutrient to maintain a strong immune system as it has a role in controlling and regulating the way the immune system responds and in attacking cells that are either infected or cancerous. “Having a low level of zinc makes a person more susceptible to disease and illness. It has been reported that zinc deficiency is responsible for over 800,000 childhood deaths in the world every year.”[48]

May Require Supplementation
People 65 and older may require zinc supplementation as well as those suffering from malabsorption or malnourishment including anorexics and bulimics. Diabetics, those on hemodialysis or with chronic renal or liver disease, severe or persistent diarrhea, and alcoholics are at risk for zinc deficiency.

“The concentration of cellular zinc is rather high, almost as high as that of ATP. Therefore, at the cellular level, zinc can hardly be considered a trace element.”
(Adv Nutr. 2013 Jan 1;4(1):82-91. doi: 10.3945/an.112.003038. Zinc biochemistry: from a single zinc enzyme to a key element of life. Maret W.)

Zinc may also be helpful for those with rheumatoid arthritis, sickle cell anemia, older breast-fed infants and toddlers, and pregnant or lactating women. HIV-infected individuals have reduced serum levels of zinc, however, the HIV virus requires zinc and too much supplementation may be stimulate the infection to progress more rapidly. Strict vegetarians may require supplementation with zinc as high amounts of phytic acid in legumes and grains hinder the absorption of zinc. Medications that decrease the absorption of zinc are antibiotics (tetracycline and quinolone) and bisphosphonates.

Symptoms of Nutrient Deficiency
- Poor Neurological Function, Learning, Memory
- ADHD
- Thinning Hair, Leukonychia Nail (white spots appearing under finger and/or toe nails)
- Lowered/Weak Immunity, Pneumonia, Food & Environmental Allergies
- Leaky Gut
- Acne, Skin Rashes, Slow Wound Healing
- Diarrhea/Persistent Diarrhea
- Inflammatory Diseases
- Age-Related Macular Degeneration
- Male Infertility, Prostate Issues
- Loss of Appetite
- Anemia
- Depressed Growth

Food Sources
Oysters, red meat, lamb, poultry (dark meat), cashews, garbanzo beans, almonds, peanuts, pumpkin seeds, mushrooms, kefir, yogurt, spinach, and cocoa powder.

Toxicity and/or Side Effects

Zinc toxicity can happen due to the consumption of food/beverages contaminated with zinc released from galvanized containers. Symptoms of acute zinc toxicity are abdominal pain, diarrhea, nausea, and vomiting. Within eight hours of zinc oxide inhalation (metal fume fever) symptoms present such as profuse sweating, weakness, and rapid breathing. Milder forms of toxicity may exhibit gastrointestinal distress. “The major consequence of long-term consumption of excessive zinc is copper deficiency." [49] Copper deficiency has also been reported following chronic use of excessive amounts of zinc-containing denture creams…[50]

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Part Three… SUPPLEMENTS

AMINO ACIDS

Amino acids and proteins "are two types of important biomolecules in the animal body. An amino acid sequence that is bound together as a string via peptide bonds is called a protein. The main difference between amino acid and protein is that amino acid is the building block of a protein whereas protein plays a vital role in the body as a structural and functional molecule. Twenty amino acids are involved in the synthesis of proteins inside living organisms. Both Amino acids and proteins can be taken into the body through the diet. Proteins in the diet are broken down into amino acids during digestion. Therefore, our body synthesizes all proteins required by the functioning of a body cell. The amino acid sequence of a protein is determined by the instructions in genes."[1]

"Six other amino acids are considered conditionally essential in the human diet, meaning their synthesis can be limited under special pathophysiological conditions, such as prematurity in the infant or individuals in severe catabolic distress.[2] These six are arginine, cysteine, glycine, glutamine, proline, and tyrosine. Six amino acids are non-essential (dispensable) in humans, meaning they can be synthesized in sufficient quantities in the body. These six are alanine, aspartic acid, asparagine, glutamic acid, serine, and selenocysteine (considered the 21st amino acid). Pyrrolysine (considered the 22nd amino acid) is not used by humans; thus, it is non-essential."[2]

"When taking individual amino acids, it is best to take them in the morning or between meals, with small amounts of vitamin B6 and Vitamin C to enhance absorption. When taking an amino acid complex that includes all of the essential amino acids, it is best to take it one-half hour away from a meal, either before or after. If you are taking individual amino acids, it is wise also to take a full amino acid complex, including both essential and nonessential amino acids, at a different time."[3]

"Keep in mind that taking any one amino acid could upset the balance of nitrogen in the body, and make it harder for the liver and kidneys eliminate waste. People with liver or kidney disease should consult a physician before taking any amino acid supplement."[4] Amino acids are not stored by the body. Excess amino acids (what is not used to make proteins or energy molecules) are broken down and eliminated which increases the levels of ammonia and urea. This can cause stress on the kidneys and is contraindicated for those with a history of uric acid-based kidney stones. Proceed wisely!

Amino acid toxicity may result at high doses causing neurological damage. Individual amino acids should be taken only for short periods of time (e.g. on for 30-60 days, off for 30-60 days, repeat if necessary) and in conjunction with an amino acid complex.

Categories of Amino Acids		
Essential	***Conditionally Essential**	**Non-Essential**
Phenylalanine (F)	Cysteine (C)	Alanine (A)
Histidine (H)	Glycine (G)	Aspartic acid (D)
Isoleucine (I)	Proline (P)	Glutamic acid (E)
Leucine (L)	Glutamine (Q)	Asparagine (N)
Lysine (K)	Arginine (R)	Pyrrolysine (O)
Methionine (M)	Tyrosine (Y)	Serine (S)
Threonine (T)		Selenocysteine (U)
Valine (V)	Note: The amino acid Pyrrolysine is not required by humans. It is used in the biosynthesis of proteins in some archaea and bacteria.	
Tryptophan (W)		

Alanine (A)

The amino acid Alanine is important as it aids in the conversion of glucose into energy. It also supports the liver in the elimination of toxins. It is also significant in that is plays a role in the conversion of amino acid waste products into pyruvate (which includes nitrogen) that is easily processed into urea by the liver and excreted by the kidneys.

"People with low-protein diets or eating disorders, liver disease, diabetes, or genetic conditions that cause Urea Cycle Disorders (UCDs), may need to take alanine supplements to avoid a deficiency. Low levels of alanine have been found in patients with hypoglycemia, diabetes, and hepatitis—it is not known at this time if alanine deficiency is the cause or result of these diseases. The body must have alanine to process the B vitamins necessary for good health, especially vitamin B5 (pantothenic acid) and vitamin B6 (pyridoxine)."[5]

Common Uses of Alanine

- Enlarged Prostate
- Fatigue (breaks down B vitamins)
- High Blood Sugar
- High Cholesterol
- Lack of Energy in the Brain & CNS
- Liver Disease & Blood Detoxification
- Low Blood Sugar
- Malfunctioning Acid Metabolism
- Muscle & Tissue Repair
- Tryptophan Deficiency*
- Waning Immunity

*(Alanine metabolizes Tryptophan and therefore may play a role in Tryptophan-related deficiencies.)

"Because fluid in the prostate gland contains alanine, it has been theorized that this amino acid may help treat benign prostatic hyperplasia (BPH), a condition in which the prostate becomes enlarged and causes urination discomfort. In one study, participants with BPH took 780 milligrams of alanine, glycine, and glutamic acid per day for two weeks, then 390 milligrams of these three amino acids for the next two and a half months, and saw a significant reduction in symptoms."[6]

Food Sources of Alanine are not limited to: Turkey, chicken, fish, beef, game, emu, rabbit, duck, egg white, avocado, and spirulina.

Cysteine (C)

Although classified as a nonessential amino acid, Cysteine should be thought of as more of a conditionally essential amino acid especially for certain infants, the elderly, those with malabsorption issues, and some with metabolic diseases. The amino acid Cysteine is a foundational component that makes up glutathione. It is also considered antioxidant in function. Cysteine is also crucial to the production of taurine, coenzyme A, biotin, and heparin. It helps to sustain the elasticity of skin and protects the lining of the GI tract.[7]

Cysteine is a sulfur-containing amino acid similar to Cystine. The body requires sufficient amounts of folate, vitamin B6, methionine, and vitamin B12 to adequately produce Cysteine.

Common Uses of L-Cysteine

- Age/Liver Spots
- Atherosclerosis
- Bronchitis (to break down mucous)
- Emphysema
- Mutagenic Disorders/Cancer
- Tuberculosis
- Rheumatoid Arthritis

Contraindications: High doses of Cysteine (over 1,000 mgs/day) may be toxic. Cysteine and its supplemental forms are capable of inactivating insulin; therefore, diabetics should use caution when supplementing. Those whose kidneys form the cystine form of kidney stones (cystinuria) should not supplement cysteine. Digestive upset and/or nausea are possible but not common side-effects.

N-Acetylcysteine (NAC)

Either cystine or NAC, a form of cysteine, may be used in place of L-Cysteine to increase glutathione levels in the body especially in the lungs, kidneys, liver, and bone marrow making it a powerful antioxidant. It is preferable to supplement NAC over oral glutathione which has not been found to be particularly stable. NAC is metabolized to cysteine and then glutathione.

One important role of N-acetyl cysteine is to assist the liver in the metabolization of acetaldehyde, an extremely toxic byproduct of the environment, more toxic than alcohol. Alcohol consumption predisposes heavy drinkers to acetaldehyde-related types of cancer due to excessive exposure to this type of toxin and the inability of the body to metabolize it efficiently.[8]

Common Uses of N-Acetylcysteine (NAC)

- Acetaminophen Poisoning
- Anti-aging
- Antioxidant
- Bronchitis
- Chemotherapy – Prevent Side Effects
- Chronic Kidney Disease
- Colorectal Cancer
- COPD
- Cystic Fibrosis
- Epilepsy
- Flu Prevention
- Homocysteine – reduces
- Kidney Damage – use prior to CT Scan or Angiogram to protect kidneys from contrast dye
- Kidney & Liver Detoxification
- Respiratory Tract Infections
- Toxin Exposure

Food Sources include poultry, egg yolks, red peppers, garlic, onions, radishes, yogurt, wheat germ, oats, dark leafy vegetables (Brussels sprouts, broccoli.)

Contraindications: High doses of Cysteine (over 1,000 mgs/day) may be toxic. Cysteine and its supplemental forms such as NAC are capable of inactivating insulin; therefore, diabetics should use caution when supplementing. Those whose kidneys form cystine kidney stones (cystinuria) should not supplement cysteine. Digestive upset and/or nausea are possible but not common side-effects.

Cystine

Closely related to the amino acid Cysteine, Cystine, a conditionally essential amino acid, is formed by two connected molecules of Cysteine.

"Cystine is required to synthesize glutathione, the cell's major antioxidant that plays a key role during tissue repair and collagen synthesis. It promotes positive nitrogen balance by minimizing muscle breakdown and rebuilding lean body mass (LBM)."[9]

Cystine is generally not available in supplement form. The commonly used form of Cystine would be N-Acetylcysteine (NAC).

Food Sources include meat, eggs, milk, broccoli, dates, and bananas.

Gamma-Aminobutyric Acid (GABA)

Technically, GABA is a neurotransmitter but, like the other amino acids, GABA is not a protein from food or any of the proteins from within the body so we will discuss it here.

Most of the GABA in the body is synthesized directly from glutamic acid and can be converted back to glutamate if needed. Its primary function in the body is as an inhibitory neurotransmitter which promotes normal brain function through protecting the central nervous system from stress-related signals. It will assist in regulating blood pressure and is found in both of the algaes, Chlorella and Spirulina.

GABA is a “smart” amino acid in that it “has a unique capacity to block its own transport across the blood-brain barrier” and can “self-inhibit its own effects in order to maintain consistency in its levels. Also, the brain is capable of expelling excessive GABA if necessary, to avoid depressive effects.”[10]

Common Uses of GABA

- ADHD
- Chronic Anxiety/Anxiety Attacks
- Hypertension
- Increase Fat Metabolism
- Increase Levels of Human Growth Hormone
- Insomnia/Sleep Dysfunction
- Lean Muscle Development
- Mood Enhancement
- Premenstrual Syndrome (PMS)
- Reduce Stress

Food sources include halibut, almonds, walnuts, chestnuts, rice bran/brown rice, buckwheat, potatoes, sweet potatoes, oats, lentils, adzuki beans, mushrooms, tomatoes, sprouted, grains, spinach, broccoli, cabbage, cauliflower, Brussels sprouts, peas, oranges, and bananas.

The *Lactobacillus* and *Bifidobacterium* found in the gut are able to produce GABA. Therefore fermented foods such as sauerkraut, yogurt, kefir, and tempeh may be helpful in increasing the amount of GABA in the gut. GABA is generally safe for short-term oral use and it is unlike to have side effects from food sources.

Contraindications: GABA supplements should not be used in conjunction with alcohol or prescribed anxiety pharmaceuticals. Excessive doses of GABA may cause “increased anxiety, shortness of breath, numbness around the mouth, and tingling in the extremities.”[11]

Aspartic Acid (D)

Aspartic Acid is beneficial as it aids cellular function as well as that of RNA and DNA. It boosts immunoglobulin and antibody production, is helpful in both neural and brain disorders, as well as being hepatoprotective by removing excess ammonia.[12]

Common Uses of Aspartic Acid

- Chronic Fatigue
- Chronic Headaches
- Deterioration of physical ability
- Intolerance to high-protein foods
- Irritability
- Poor Concentration
- Reduced Stamina

Food sources are seed sprouts, oats, asparagus, avocado, beef, dairy, sugar cane, poultry, and molasses. It is frequently in supplements as either “aspartic acid” or magnesium aspartate.[13]

Excessive amounts of ammonia and low levels of Aspartic Acid can be damaging to the brain, the liver, and the nervous system. There is often a correlation between Aspartic Acid deficiency and deficiencies in calcium and magnesium.[14]

Contraindications: High doses of Aspartic Acid (over 6,000 mgs/day) may be toxic and potentially cause neurological damage.

Glutamic Acid (E)

Glutamic Acid is a major excitatory neurotransmitter in the central nervous system of mammals that can only stimulate nerve cells with glutamate receptors specifically designed to react to the glutamate protein. It is also a precursor to Gamma-Aminobutyric Acid, otherwise known as GABA. It is also useful for its ability to detoxify ammonia.

Glutamic Acid helps correct personality disorders and is useful in treating childhood behavioral disorders. It is used in the treatment of epilepsy, mental retardation, muscular dystrophy, ulcers, and hypoglycemic coma, a complication of insulin treatment for diabetics."[15]

Common Uses of Glutamic Acid

- Concentration/Learning Difficulties
- Insomnia
- Low Energy Levels
- Memorization Difficulties
- Mental Exhaustion
- Neurological Dysfunction

Food sources are meat, dairy, eggs, mangoes, and high protein plants.

Contraindications: High doses of Glutamic Acid (over 6,000 mgs/day) may be toxic and potentially cause neurological damage.

Phenylalanine (F)

Phenylalanine is an essential amino acid that can cross the blood-brain barrier. It is a precursor to tyrosine which is a precursor to epinephrine, dopamine and norepinephrine which heighten mood and increase attentiveness. It also has been used to treat schizophrenia and may aid melatonin production in vitiligo.

It is significant to note that: "Epstein-Barr virus and chronic fatigue syndrome have been linked to excessive alanine levels and low levels of tyrosine and phenylalanine."[16]

Common Uses of Phenylalanine

- ADHD
- Age/Liver Spots
- Alcohol Withdrawal Symptoms
- Chronic Pain
- Depression
- Memory/Learning
- Menstrual Cramps
- Multiple Sclerosis
- Obesity
- Osteoarthritis
- Parkinson's disease
- Premenstrual Syndrome (PMS)
- Rheumatoid Arthritis
- Vitiligo
- Weight Loss/Appetite Suppression

Food sources include meat, fish, eggs, cheese, and milk.

Contraindications: Do not take if pregnant. Not for those who experience anxiety attacks, diabetes, high blood pressure, migraines, phenylketonuria (PKU), or skin cancer. Not to be taken with prescribed antidepressants. Nerve damage may result from large doses of phenylalanine.

Glycine (G)

Glycine is made by the human body, but not enough to serve the body's needs in total. It is highly concentrated in the skin, joints, and muscle/organ connective tissue. As precursor to proteins, Glycine increases the absorption of magnesium.

Additional glycine may be advantageous for people recovering from surgery. It is also important for healing the lining of the GI tract, producing bile salts, and digestive enzymes. It is known to reduce cartilage loss in joints and collagen loss in skin.

Glycine is beneficial to diabetics by causing glucagon to remove excess insulin from circulation thereby regulating blood sugar. It also a necessary part of building lean muscle mass, preventing muscle deterioration, and muscle wasting. Glycine also boosts glutathione which in turn reduces inflammation and free radical damage.

Common Uses of Glycine

- Arthritis
- Blood Sugar Regulation (High/Low)
- Chronic Fatigue
- Diabetes Mellitus
- Epileptic Seizures
- Fatigue
- Heart Failure
- Insomnia/Sleep Disturbances
- Kidney Failure
- Leaky Gut Syndrome
- Ulcers

Food sources. Bone broth is a superior source for glycine as it is made from cartilage, tendons, collagen, and bones of animals. Other sources are meat, fish, gelatin, pumpkin and squash seed kernels, peanuts, sesame seeds, mustard seeds, and vegetables.

Contraindications: Too much Glycine can cause fatigue while the right amount is energizing.

Histidine (H)

Histidine is a unique amino acid found in almost every cell of the body and considered essential for human infants, yet becomes 'non-essential' when the body matures and begins to synthesize its own Histidine using imidazole, a chemical structure found within the Histidine molecule itself.

Histidine is also "key to the formation of the myelin sheath, the protective barrier that surrounds neural cells and supports the transmission of brain signals to different parts of the body. It also participates in the detoxification of heavy metals and other cellular debris for elimination through the liver and kidneys. This substance is necessary in order for the body to manufacture both white and red blood cells. Finally, since this acid is involved in the production of histamine, it

plays a role in making gastric enzymes needed for proper digestion, assisting the immune system in responding to the presence of allergens, and promoting normal sexual function."[17]

Common Uses of Histidine

- AIDS (may help prevent)
- Allergies
- Decreased Tissue Repair & Growth
- Decreased Red & White Blood Cell Production
- Accumulation of Heavy Metals
- Rheumatoid Arthritis
- Nerve Deafness
- Lack of Sexual Arousal
- Lack of Stomach Acid & Resulting Indigestion
- Lack of Gastric Acid Secretion

Food sources of Histidine are found in high-protein foods such as meat, poultry, fish, seafood, eggs, rice, potatoes, nuts, legumes, chickpeas (a rich source), wheat, rye, cauliflower, mushrooms, tomatoes, zucchini, asparagus, peppers, cucumbers, squash, onion, cabbage, Brussels sprouts, bamboo shoots, watercress, spinach, bananas, tangerines, pineapples, guavas, etc.

Those who are chronically ill or arthritic may improve with histidine supplementation. A daily therapeutic dose ranges from 0.5 to 20 grams. Up to 30 grams per day has shown no adverse side effects in adults for limited time periods.[18]

Histidine levels that are too high can lead to stress and psychological disorders. High levels of histidine have been found in those with schizophrenia. Methionine supplementation can lower histidine.[19]

Contraindications: Do not recommend Histidine supplements to clients with inflammation, allergies, kidney disorders, or bipolar depression.

Isoleucine (I)

Isoleucine is an essential amino acid and the first of a group of three branched-chain amino acids (BCAAs) isoleucine, leucine, and valine. The term 'branched-chain' refers to the long chains of linked essential amino acids which are carrying nutrients and have the ability to build muscle protein. Each chain has a forked outcropping that resembles a branch. (Think: fork –> food –> nutrients!) Together these long chains of amino acids full of nutrition are metabolized within muscle tissue to produce energy.

Isoleucine is necessary for the formation of hemoglobin and also a regulator of energy and blood glucose. It should not be supplemented alone, rather, Isoleucine should be taken in moderation along with L-Leucine and L-Valine in the proper proportions. It is included in many supplement combinations.

Common Uses of Isoleucine

- Depression
- Mental & Physical Disorders

Food sources of Isoleucine are meat, liver, turkey, chicken, game, fish, eggs, brown rice, lentils, rye, almonds, cashews, spinach, and sunflower seeds.

The Three 'Muscle'-teers!

~ Branched-Chain Amino Acids (BCAAs)

The three BCAAs are leucine, isoleucine, and valine. "Branched-chain amino acids can increase muscle protein synthesis. This makes them both anabolic (muscle building) and anti-catabolic (protect against muscle damage)."[20] This is what makes supplementation appealing to athletes. Stronger muscles that recover quickly after a workout.

"Muscle protein synthesis is when amino acids combine to form muscle tissue. Protein synthesis stimulates insulin production, which allows blood sugar to be taken up by the muscle cells and used as energy. This insulin production promotes amino acid uptake by the muscle."[21]

It is theorized that BCAAs slow the breakdown of muscle, therefore, "they have been integral in the treatment of people who are confined to bed rest following the diagnosis of muscular sclerosis." "For many years, people from around the world have been using these types of amino acids for medicine because of their therapeutic and restorative powers. BCAAs have been used to treat everything from ALS (commonly known as Lou Gehrig's disease), to liver disease, movement disorders, genetic diseases, and kidney failure."[22]

While individual BCAAs do have benefit unique to themselves, they work best synergistically. "Scientists from Baylor University gave college-aged men either a leucine supplement, a 2:1:1 BCAA supplement, or a placebo before and after a leg workout. They discovered that while leucine increased MPS after the workout better than the placebo did, the mixed BCAAs increased protein synthesis even better than leucine and the placebo."[23] This is that study if you would like to take a look: The effects of oral BCAAs and leucine supplementation combined with an acute lower-body resistance exercise on mTOR and 4E-BP1 activation in humans: preliminary findings J Int Soc Sports Nutr. 2008; 5(Suppl 1): P21.

When BCAAs are deficient, even if only one of the amino acid trio is deficient and the synergy of the trio is disrupted, hypoglycemic-like symptoms may present such as: confusion, dizziness, fatigue, headaches, and irritability. In general, most people that eat meat get sufficient BCAAs.

Lysine (K)

Lysine as an essential amino acid is a crucial building block for all protein because the body uses only L-lysine. Men tend to need more lysine as they age. Without supplementation, vegetarian and low-fat diets cannot satisfy the body's need for lysine.

It is lysine that builds the proteins that make up muscle and collagen as well as for tissue repair and accelerating bone healing after injuries or surgeries. Lysine is both beneficial for calcium absorption and placement into bone. It is also able to reduce high blood triglyceride levels. Lysine has many other functions as well: it helps with the production of antibodies in the immune system, enzymes in the digestive system, nitrogen metabolism, gallbladder function, pineal and mammary gland activation, and amino acid assimilation.[24]

Lysine is well-known for its usefulness in suppressing the Herpes simplex-1 (HSV-1) virus and cold sores in conjunction with vitamin C with bioflavonoids. Periods of stress quickly deplete lysine cellular reserves and allow the opportunistic herpes virus to surface.

"In a study of 30 participants, a cream with L-lysine, zinc, and herbs cleared herpes symptoms in 40% of the participants by the third day and 87% by the sixth day. When herpes is not treated with lysine, outbreaks may last 21 days."[25]

Common Uses of Lysine

- Anemia
- Ataxia
- Agitation
- Anxiety
- Atherosclerosis
- Bloodshot Eyes
- Dental Caries
- Diabetic: Eye & Nerve Cell Damage
- Enzyme Disorders
- Excessive Hair Loss
- Fatigue
- Impaired Bone & Collagen Formation (Fragile Bones)
- Impotence
- Inflamed Pancreas
- Irritability
- Kidney Stones
- Lack of Focus, Hyper-stimulated
- Lack of Growth Hormone (Stunted Physical & Intellectual Growth)
- Loss of Appetite/Weight Loss
- Lowered Insulin & High Blood Sugar Levels
- Mood swings
- Nausea, Dizziness
- Poor Energy
- Reproductive Disorders
- Schizophrenic 'anxiety-like' Symptoms

Arginine and lysine are antagonistic. When supplementing lysine, it is best to avoid consuming foods containing high amounts of arginine such as gelatin, nuts, and chocolate.

Food sources. Red meat, cheese, eggs, fish, lima beans, potatoes, grains, milk, and yeast. Grinding grains (milled wheat and corn) destroys lysine as does cooking any lysine-containing food with sugar.

Contraindications: Hypoglycemia may result from over-supplementation of Lysine.

Leucine (L)

Leucine is an essential amino acid and the second of three branched chain amino acids (BCAAs) isoleucine, leucine, and valine. It is used by the liver and also facilitates muscle protein creation thereby increasing energy and endurance. Leucine is also helpful for stabilizing blood sugar levels.

Common Uses of Leucine

- Confusion
- Depression
- Dizziness
- Fatigue
- Headaches
- Hypoglycemic-like Symptoms
- Irritability

Food Sources of Leucine include meat, brown rice, beans, nuts, whole wheat.

Contraindications: Excessive leucine supplementation may increase ammonia by the disruption of liver and kidney function and contribute to pellagra, an extreme niacin deficiency that causes dermatitis, diarrhea, and mental disorders.

Beta-hydroxy-beta-methylbutyrate (HMB)

HMB is a metabolite of the amino acid leucine that slows protein breakdown and promotes the production of lean body mass (muscles.) Lean body mass decreases with age, therefore it is important to maintain musculature for day-to-day health and healing, especially for the frail elderly and those who are convalescing. Another area where HMB is gaining in popularity is in the area of body-building and endurance sports.

Research has shown HMB to have the ability to significantly reduce LDL cholesterol and systolic blood pressure which has further potential to reduce the risk of heart attack and stroke.

When the body is functioning optimally it "can produce 0.3 to 1 gram of HMB per day in muscle tissue."[26]

Food sources of HMB are found in plants and animals. Although more highly concentrated in foods such as grapefruit, alfalfa, and catfish, one would have to eat several pounds each day to even get close to a beneficial effect.

Methionine (M)

Methionine is one of four sulfur-containing amino acids. The other three are cysteine, homocysteine, and taurine. Methionine is used by the body to make proteins and peptides. The body does produce methionine, however, "supplementing with L methionine has been shown to help heal wounds and those experiencing Parkinson's, drug withdrawal, schizophrenia, radiation, copper poisoning, asthma, allergies, alcoholism, liver damage and depression."[27]

Common Uses of Methionine

- Anemia
- Elevated Cholesterol
- Depression (Methionine raises the levels of its metabolite SAM-e)
- Fatty Liver (Steatohepatitis)
- Gray Hair
- Increased risk of Atherosclerosis
- Insufficient Cartilage Repair
- Parkinson's-related Tremors

"Although methionine deficiency can produce unpleasant symptoms, consuming excessive levels of the amino acid can produce adverse consequences as well. In a study published in the January 2010 issue of 'Current Alzheimer Research,' researchers at Philadelphia's Temple University reported that the body converts excessive Levels of methionine to homocysteine, high blood levels of which appear to increase the risk of dementia."[28]

Food sources: Turkey, chicken, wild-caught fish, elk, beef, port, egg whites, milk, cheese, nuts, sesame seeds, sunflower seeds, beans, oats, quinoa, seaweed, and spirulina.

Contraindications: High doses of methionine can raise blood levels of homocysteine which can damage blood vessels and also increase the risk of blood clots.

Carnitine

Carnitine is more closely related to B vitamins than amino acids, yet because of the similarity of its chemical structure is grouped with amino acids.

One of Carnitine's outstanding functions in the body is its work as a neurotransmitter and a major energy source for muscles. It also inhibits the buildup of fat in skeletal muscles, the heart muscle, and the liver. It also increases the potency of the antioxidants vitamin C and vitamin E.

"Carnitine reduces the health risks posed by poor fat metabolism associated with diabetes; inhibits alcohol-induced-fatty liver; and lessens the risk of heart disorders. Studies have shown that damage to the heart from cardiac surgery can be reduced by treatment with carnitine. It has the ability to lower blood triglyceride levels, aid in weight loss, and improve muscle strength in people with neuro-muscular disorders. Conversely, it is believed that carnitine deficiency may be a contributor to certain types of muscular dystrophy."[29]

Carnitine deficiency can also result from a genetic defect in carnetine synthesis called Primary Carnitine Deficiency. While some individuals have no presenting symptoms, "the nature and severity of signs and symptoms may vary, but they most often appear during infancy or early childhood and can include severe brain dysfunction (encephalopathy), cardiomyopathy, confusion, vomiting, muscle weakness, and hypoglycemia."[30] An inherited defect in the metabolism of carnitine may also play a factor in slightly increasing the risk of autism in some children.[31]

Common Uses of Carnitine

- Clumsiness
- Confusion
- Fatigue
- Heart Pain
- High Liver Enzymes
- Hypoglycemia
- Muscle Weakness
- Obesity
- Seizures

Carnitine is not found in vegetable protein nor is lysine or methionine. The amino acids lysine and methionine are the raw materials required by the body to make its own carnitine along with adequate iron, and the B vitamins B-1 and B-6. In light of this, clients adhering to a plant-based diet such as vegans or vegetarians should supplement to sustain both physical and mental

health. Additionally, consider supplementation for those who are malnourished from exceedingly poor diets such as the elderly who forget to eat, those with anorexia/bulimia, etc.

Food sources of carnitine include red meat such as beef, cod (the highest seafood source), fish, shellfish, and chicken breast.

Asparagine (N)

Asparagine was named after asparagus, the plant it was first isolated from in 1806. It plays a significant role in preventing autoimmunity and in the brain development of children. It is required to maintain homeostasis in the CNS keeping one from being overly nervous or overly calm. It also may improve the body's resistance to fatigue, renew damaged and aging skin cells, and aid the liver by metabolizing ammonia. This may have a positive effect on symptoms of confusion, depression, and headaches caused by the inability to excrete urea.[32]

Common Uses of Asparagine

- Allergies & Severe Allergies
- Autoimmunity
- Cognitive Function Deficits
- Confusion
- Depression
- Headaches

Food Sources of Asparagine are asparagus, dairy, whey/lactalbumin, legumes, many meats, nuts, potatoes, seafood, seeds, and whole grains.

Contraindications: The amino acid "asparagine has the highest tendency to turn into acrylamide [a carcinogenic chemical] when heated, asparagine plays an insufficient factor (though necessary) in acrylamide formation. It takes a combo of other substances such as oxidized fat, sugar and asparagine plus the temperature 250-375 F, 121-191 C to form acrylamide."[33] [my clarification]

Highly heated, processed foods should be of great concern, primarily when they are a consistent and substantial part of the diet. Foods high in acrylamide are the processed sweet potatoes and biscuits in baby food, bakery products, coffee, crackers, dried foods (noodles and soup mixes), French fries, potato chips, cereals, processed chocolate products, roasted nuts, smoked nuts, snacks such as soy crisps, pretzels, veggie crisps, and toast.[34]

Fresh and unprocessed foods are generally safe and should be consumed as asparagine is necessary to the body. The body will detox acrylamide by binding it to glutathione. Glutathione levels are increased by consuming sulfur-bearing foods such as cruciferous vegetables, onion, and garlic.

Food sources include dairy, beef, poultry, and eggs.

Pyrrolysine (O)

The 22nd amino acid, Pyrrolysine, is not required by humans. It is an amino acid found in methanogenic bacteria.

Proline (P)

Proline is considered a non-essential amino acid in humans. It is synthesized by the essential amino acid L-glutamate. Deficiency is a rare occurrence as proline is available in a wide variety of foods. People on low protein diets or very strict vegans and vegetarians who do not combine their proteins and amino acids in their foods correctly, may become deficient in proline. If someone is deficient in Proline, they are almost certain to be deficient in all of the amino acids.

Common Uses of Proline

- Tears or strains of soft tissues
- Slower than average healing times

Glutamine (Q)

Glutamine, a building block for proteins and also a critically important part of the immune system, is a conditionally essential amino acid. Although the body is capable of producing Glutamine there are times when it is necessary to get it from dietary sources such as during an illness or an injury. "Glutamine functions as a fuel source for fibroblasts and epithelial cells needed for healing. While the safe maximum dosage for glutamine has been established as 0.57 grams per kilogram of body weight, studies on the effectiveness of consuming supplements containing glutamine to heal wounds are inconclusive."[35]

Glutamine is wonderful for gut health as it reduces intestinal inflammation and assists in the development of a healthy microbiome. Glutamine "plays a very important role in both cellular and systematic detoxification processes. The lymphatic system maintains fluid and protein balance in the body, carries immune cells, and filters out toxins that are stored in tissues."[36] It actually increases the performance of lymphatic cells in the removal of toxins and works to transport ammonia from the brain (it is one of the few amino acids able to cross the blood brain barrier) and other body tissues.

Stress, whether it be physical, emotional, or mental, will reduce circulating glutamine because there is a greater release of cortisol in the body during these times which decreases the production of glutamine.

Common Uses of Glutamine

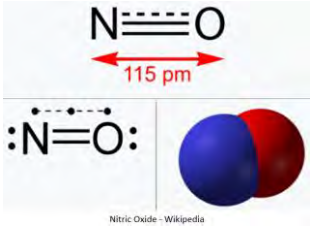
- Anxiety
- Inflammatory Bowel Disease (IBS)
- Depression, Sadness (inappropriate for situation)
- Diarrhea
- Fatigue
- Increased Infection
- Poor Athletic Performance/Recovery
- Poor Recovery from Injury
- Poor Nutrient Absorption
- Weak Immune System
- Abnormal or 'Disease-Related" Weight Loss

Food sources include milk, beef/bison/venison, poultry, bone broth, eggs, beans, asparagus, carrots, broccoli, cabbage, celery, spinach, parsley, sauerkraut (and other fermented foods), spirulina.

Arginine (R)

Arginine – A conditionally essential amino acid and antioxidant, Arginine boosts the immune system and "several functions including accelerating insulin secretion, stimulating protein, and promoting the transport of amino acids into the cells."[37] Last but not least, Arginine has the ability to enable the production of nitric oxide, a gas which acts as a neurotransmitter and helps blood vessels relax, and improve circulation and reduce blood pressure.

"Nitric oxide is essential for wound healing because it increases the oxygen and blood flow to the wound, increases collagen formation, and reduces inflammation. While arginine is the only producer of nitric oxide, 40% of ingested arginine is broken down by the intestines and liver, which reduces the amount available for nitric oxide production.[37]



~ Nitric Oxide– NO2

Nitric oxide (NO) "has many important biological functions. It relaxes the walls of blood vessels, causing vasodilation (widening of the vessels). This allows more blood to flow into the heart and other organs. It also acts as a signaling molecule between nerve cells. In addition, it plays an important role in our immune system and helps it to fight infections."[38]

One of the best ways to increase nitric oxide in the body is through cardiovascular exercise. A short 10 or 15 minutes of gentle cardio is all it takes to increase blood oxygen. Additionally, the antioxidants vitamins C and E, polyphenols (found in food and 100% food-derived nutrients), and glutathione are important to NO production in the body.

Two amino acids beneficial to the production of NO are L-Arginine and L-Citrulline. Citrulline, a precursor to arginine, "circumvents the liver and intestine breakdown, converts to arginine, and increases nitric oxide production."[37]

These amino acids work best as a team and are key to the metabolism and utilization of protein, and in maintaining muscle tissue. Both participate in the detoxification of ammonia via the production of urea. Arginine that has not been converted to urea is circulated and distributed to various tissues to be metabolized for other uses such as protein synthesis. Supplementing Citrulline with Arginine helps to maintain nitrogen balance better than either could alone and are often combined in supplements.

Foods (such as vegetables) that naturally contain nitrates convert to nitrites once they mix with salivary enzymes. They further convert to nitric oxide when exposed to stomach acid. The kidneys will convert L-Citrulline back into L-arginine leaving NO as the byproduct. NO can then be recycled back into arginine.

continued…

Nitric Oxide – N02 continued

Food Sources: Beetroot/beet juice, garlic, kale, celery, cress, chervil, spinach arugula, cabbage, dark chocolate, foods with vitamin C such as citrus, and pomegranate. The nitrates in these foods are quickly converted into nitric oxide because vegetables that are high in nitrates are also naturally high in antioxidants that boost the conversion process into nitric oxide.

Nitrates found in vegetable sources should not be confused with the harmful sodium nitrates used to preserve the color and freshness of bacon, hot dogs, and other meat products. Although vegetables have nitrates, they also possess naturally-occurring antioxidants that neutralize the formation of the N-nitroso compounds that have been linked to bowel cancer.

"Though the normal person can make enough arginine within the body for necessary function, people with inadequate protein in their diet or rapid growth may need additional arginine. Persons with excessive lysine intake or excessive ammonia production may also upset their arginine production. Those with medical conditions such as burns, infections, sepsis and urea synthesis disorders may require additional arginine supplementation."[38]

Common Uses of Arginine

- Cancer
- Constipation
- Decreased Immune Function
- Delayed Sexual Maturity
- Diminished Insulin Production
- Erectile Dysfunction
- Fatty Liver (Cannot Process Fats)
- Hair Loss
- High Blood Pressure
- Impaired Kidney Filtering
- Lack of Libido (male/female)
- Low Sperm Count/Motility
- Male Sterility/Low Sperm Count
- Poor Blood Vessel Functioning
- Poor Fat Burning
- Poor Wound Healing, Especially Burns & Infections
- Skin Rash

Food sources: Turkey breast, chicken, beef, Lupins, lentils, chickpeas, peanuts, walnuts, almonds, pine nuts, sesame seeds, sunflower seeds, pumpkin seeds, pumpkin leaves, mustard greens, spinach, watercress, spirulina, seaweed.

Stomach upset and diarrhea are common side effect, so start slowly and build with tolerance.

Contraindications: Arginine supplements should be avoided by those with cirrhosis of the liver or low blood pressure. High levels of arginine can disrupt the balance of arginine and lysine as they utilize the same pathway of absorption. Too much arginine can lead to herpes outbreaks or cold sores as it is needed for herpes to reproduce.

Serine (S)

Serine – A non-essential amino acid obtained from the amino acid Glycine, Serine is the precursor to amino acids such as Glycine and Cysteine. It is necessary in digestion as it assists enzymes in the hydrolysis of polypeptides and proteins. Serine also boosts the production of immunoglobulins and antibodies that make for a thriving immune system.

"One of the Serine's functions is to help form the phospholipids which are necessary for creating every cell in the human body. In addition, this amino acid is involved in the functioning of RNA and DNA, in the muscle formation as well as in the maintenance of a proper immune system. Tryptophan, an essential amino acid used to make serotonin (a mood-determining brain chemical), also cannot be produced without Serine. Meanwhile, both serotonin and Tryptophan shortages are believed to cause depression, insomnia, and anxiety. Numerous researches suggest that low levels of this amino acid are responsible for the chronic fatigue syndrome and fibromyalgia."[39]

"Prompt recognition of affected patients is important, since serine deficiency disorders are treatable causes of neurometabolic disorders. The use of age-related reference values for serine in CSF and plasma can be of great help in establishing a correct diagnosis of serine deficiency, in particular in newborns and young children."[40]

Sufficient amounts of vitamin B and folate are necessary for the production of Serine.

Common Uses of Serine

- Fibromyalgia
- Increased Muscle Tone
- Low levels of serine & glycine in cerebrospinal fluid
- Low Plasma Glycine Level
- Mild Mental Retardation
- Psychomotor Retardation
- Retarded Fetal Growth
- Retarded Growth, Post Birth
- Seizures
- Small Head (Congenital Microcephaly)
- Psychomotor Retardation

Food sources: Meat, gelatin, fish, eggs, dairy, peanuts, sunflower seeds, pumpkin/squash seeds, sesame seeds, Lupins, nuts.

Contraindications: High doses of Serine (over 6,000 mgs/day) may be toxic and potentially cause neurological damage.

Threonine (T)

Threonine, an essential amino acid that supports the central nervous system, the liver, the cardiovascular, and the immune system. It participates in the synthesis of serine and glycine and is necessary in building strong bones and the enamel on teeth. "Since Threonine is found largely in the central nervous system, it can be really helpful in treating different types of depression. This amino acid makes up elastin, collagen, and enamel protein, and even promotes the proper fat metabolism in the liver. Finally, Threonine is known for aiding the

digestive and intestinal tracts to function more smoothly, as well as for helping in metabolism and assimilation."[41]

"Threonine works the following way: it combines with aspartic acid and Methionine to jointly help liver digest fats and fatty acids. This process helps reduce the accumulation of fat in the liver, which would otherwise affect the liver function. This amino acid is also useful in treating Lou Gehrig's disease, aka Amyotrophic Lateral Sclerosis. Scientific researches show that Threonine treatment also helps alleviate symptoms of Multiple Sclerosis - another disease affecting nerves and muscles. Besides, Threonine is recognized as an immunostimulant promoting the growth of thymus gland."[42]

Common Uses of Threonine

- Confusion
- Digestive Difficulties
- Emotional Agitation
- Fatty Liver

Food sources: Lean beef, lamb, chicken, turkey, liver, fish, shellfish, eggs, cheese, beans, lentils, pumpkin/squash seeds, flax seed, chia seed, peanuts, watermelon seeds, sunflower seeds, pistachios, cashews, almonds, quinoa.

Contraindications: High doses of Serine (over 6,000 mgs/day) may be toxic, cause the formation of too much urea/ammonia toxicity, and potentially cause neurological damage.

Selenocysteine (U)

The 21st amino acid. The sulfur molecule of 'cysteine' is substituted with a selenium molecule. Selenocysteine is the catalytic center in glutathione peroxidase.

"Selenocysteine is found in various enzymes such as glutathione peroxidases, thioredoxin reductases, tetraiodothyronine 5′ deiodinases, glycine reductases, formate dehydrogenases, methionine-R-sulfoxide reductase B1 (SEPX1), selenophosphate synthetase 2, and some hydrogenases. Proteins with more than one selenocysteine residues are known as selenoprotein."[43]

Selenocysteine, an antioxidant, is foundational for the building of selenoproteins (selenium-containing proteins.) These proteins are important because they act primarily as enzymes in the conversion of the thyroid hormone thyroxine (T4) into its active form triiodothyronine (T3.) It can also be converted into glucose. Supplements containing Selenocysteine are a source of selenium.

Food Sources of Selenocysteine are found in meat, poultry, egg, fish and seafood, cheese, turkey, grains, walnuts and Brazil nuts (an especially high source.)

Contraindications: Excessive supplementing with Selenocysteine can cause "garlic breath," brittle hair and nails, itchiness or tingling, nausea, vomiting, and diarrhea.

Valine (V)

Valine is an essential amino acid and the last of three branched chain amino acids (BCAAs) isoleucine, leucine, and valine. Valine works with isoleucine and leucine to promote normal growth, tissue repair, blood sugar regulation, and to create energy. It helps correct mental functioning by stimulating the nervous system.

Valine is an essential, growth-promoting amino acid that works with isoleucine and leucine to repair tissue, regulate blood sugar, and in muscle metabolism. It is found in high concentrations in muscle tissue where it is used as an energy source. As such it is a popular supplement for bodybuilders and athletes because of its ability to prevent the breakdown of muscle and to boost performance.

Common Uses of Valine

- Muscle Fatigue
- Slow Tissue Repair
- Slow Post Exercise Recovery

Valine should always be supplemented in conjunction with L-isoleucine and L-leucine. It is helpful for correcting severe deficiencies of amino acids. It has been successful when used in treatment of cirrhosis of the liver, phenylketonuria, tardive dyskinesia (a side-effect of antipsychotic medications,) athletic performance enhancement, mental decline and post-exercise infection at extreme temperature.[44]

Food sources include dairy, grains, meat, salmon, mushrooms, peanuts, and soy.

Contraindications: Excessively high concentrations of valine called Valinemia cause formication which is a crawling sensation in the skin and sometimes even hallucinations. "An affected newborn will present with abnormally high concentrations of acidic metabolic by-products of the BCAAs [branch-chain amino acids] in the blood and other tissues (metabolic acidosis) that, if left untreated, may lead to seizures or coma, and may be life-threatening."[45][*clarification mine*]

Valine will present in high levels in the blood and urine and is caused by a deficiency of the enzyme valine transaminase. "The breakdown of valine involves at least seven stages and a deficiency of the appropriate enzyme at any of these stages leads to a disorder of varying severity and rarity."[46]

Tryptophan (W)

An essential amino acid that the body does not make. It must come from food. L-tryptophan is converted into 5-HTP (See 5-HTP below for details) and into serotonin which reduces mood swings (especially those related to PMS), depression, promotes weight loss, induces sleep (L-Tryptophan is also an important precursor to melatonin that prepares the body for sleep.) "L-tryptophan depletion seems to be a significant factor demonstrating the link between serotonin and depression."[46]

The amino acid L-Tryptophan is also a requirement to produce certain protein structures in the body. It is valuable for "maintaining the immune system, stimulating muscle growth through amino acid sparing and promotion of amino acid transport into muscle cells, and burning fat."[46] It can also raise Human Growth Hormone (HGH) and because of this is used as an anti-aging supplement.

"Plasma tryptophan ratios are below normal in obese subjects and may decrease with dieting, an effect that may partly be responsible for the high relapse rate after diet-related weight loss (ie, brain serotonin production remains low and stimulates appetite). Obese subjects are often insulin resistant, and diminished insulin action may cause low plasma tryptophan ratios because of the peripheral effects of insulin on amino acid uptake and utilization."[47]

Common Uses of Tryptophan

- Alopecia
- Anxiety, Panic Disorder
- Autism
- Bipolar Disorder, Mania
- Cataracts, Corneal Vascularization
- Impulsive or Aggressive Behavior
- Insomnia
- Depression/Seasonal Affective Dis. (SAD)
- Motion Sickness
- Obesity (Less easily satiated)
- PMS, Mood Swings, Tension, Irritability
- Poor Memory/Memory Loss/Dementia

Food sources of Tryptophan come from salmon, tuna, crab, lamb, beef, poultry, game, whole eggs, spinach, spirulina, sunflower, brown rice, nuts, pumpkin and squash seeds, spearmint, cacao, and more. During digestion, tryptophan is broken down into 5-HTP, which is then used to create serotonin, melatonin, and vitamin B3.

Contraindications: High doses of Tryptophan (over 6,000 mgs/day) may be toxic and potentially cause neurological damage.

Tryptophan (W) converts to ->

5-HTP (5-Hydroxytryptophan)

5-HTP is an important mood-regulating hormone that works by first being converted to Tryptophan and then is further converted into the neurotransmitter serotonin. As a supplement 5-HTP is more beneficial than a serotonin supplement because it can enter the brain directly from the bloodstream, while serotonin cannot.

It is used exclusively to produce serotonin in the intestines which then moves on to effect the brain and nervous system where it reduces insomnia, depression, anxiety, migraine or tension headaches, premenstrual syndrome (PMS), premenstrual dysphoric disorder (PMDD), attention deficit-hyperactivity disorder (ADHD), seizure disorder, Parkinson's disease, and suppresses appetite by causing feelings of satiation to occur sooner. 5-HTP has been shown to be clinically therapeutic in the treatment of chronic fatigue syndrome and fibromyalgia,

"It's important to note, however, that 5-HTP may not be an effective long-term treatment for low serotonin levels. Italian researchers, for example, tested the effects of 5-HTP on young men

with romantic stress over 6 weeks. The researchers found that 5-HTP produced significant increases in the participant's serotonin levels over the first 3 weeks. After that, it had little effect."[48]

Begin with a small 50 mg dose 23-30 minutes before meals. "Early research suggests that taking 100 mg of 5-HTP by mouth three times daily for 30-90 days might improve pain, tenderness, sleep, anxiety, fatigue, and morning stiffness in people with fibromyalgia."[49] Note, this is for short-term use only. Do not take 5-HTP longer than 12 weeks.

Contraindications: Do not combine 5-HTP with tryptophan or any other supplements that affect serotonin levels such as SSRIs or MAOIs (antidepressants). Do not take if pregnant or breastfeeding or if diagnosed with severe depression or bipolar disorder as 5-HTP may increase suicidal ideation.

Tyrosine (Y)

This non-essential amino acid is produced by the body, but it is not uncommon for some to under produce. It is significant in that Tyrosine is used by both the thyroid and the adrenals as a deficiency can frequently show up in symptoms related to those organs. Tyrosine can be helpful for mood, focus, memory, fatigue, and energy as well as opiate, methamphetamine, and tobacco cravings. It may also enhance performance under stress.

Tyrosine can be helpful in lowering blood pressure, the effects of which are enhanced by taking it in conjunction with vitamin C. As it utilizes the same transport channels the other amino acids do, taking Tyrosine separately from other amino acids may boost its effects for some people as it requires liver hydroxylation and appears to benefit from less competition by the other amino acids.

Common Uses of Tyrosine (Phenylalanine)

- Anxiety
- Arthritis
- Chronic Fatigue Syndrome
- Cold Hands & Feet
- Depression
- Epstein-Barr Virus
- Headaches
- Hypothyroidism
- Low Blood Pressure
- Menstrual Cramps
- Migraines
- Narcolepsy
- Obesity
- Parkinson's Disease
- Restless Leg Syndrome
- Schizophrenia
- Social Anxiety
- Stress

Food sources of Tyrosine can be found in raw spirulina (one of the highest food sources of Tyrosine), dried spirulina, turkey, cheese, quail, game, raw pumpkin leaves, shrimp, mustard greens, chicken, fish, beef, lamb, fish, nuts, seeds, eggs (especially the whites), dairy, pumpkin flesh, spinach, avocado, banana, beans, whole grains, and sesame seeds.

AMINO ACIDS & PROTEIN (The Rebuilders of Tissues & Organs)

Amino acids are the building blocks of proteins. Enzymes break down proteins into amino acids and rebuild them into whatever the body needs: energy, DNA, digestion of food, tissue rebuilding, etc. A significant amount of the body is made up of protein, approximately 20 percent. It is important to take in an appropriate amount of protein each day because protein is not stored. There are those that think that 'protein is protein', so it shouldn't matter whether it comes from plants or animals, however, that is not necessarily the case. When it comes down to the 'nuts and bolts' of it, the amount and type of amino acids that make up proteins are significantly varied between sources of animal and vegetable protein.

A 'complete' source of protein contains all nine of the essential amino acids. This is what the human body needs for proper function. Animal proteins are superior to plant proteins as they contain all of these essential amino acids and are very similar to the proteins found in the human body.

Soy, although considered by some to be a complete plant protein, is deficient in methionine and low in lysine (compared to dairy). Soy must be processed to improve digestibility, this processing further reduces chymotrypsin and trypsin.[50] Additionally, it has been found that soy contributes to choline deficiency and is suspected to be a causative factor of "hepatocyte damage and lipid accumulation"[51] in non-alcoholic fatty liver disease.

Additionally, plant foods often lack in nutrients that are readily found in animal protein such as Vitamins B-12 and D, heme-iron and zinc. Regardless, there are plenty of much-needed nutrients in fruits and vegetables, therefore, each person ought to be encouraged to eat a healthy diet with sufficient protein (and not too much) including lots of plant-based foods. "A diet high in plant protein is linked to a lower risk of heart disease, diabetes, and obesity."[52]

BONE BROTH

Bone broth is an easily digestible and nutrient-dense "liquid containing brewed bones and connective tissues. To make bone broth, people use cow, chicken, even fish bones. Drinking bone broth may be beneficial for the joints and digestive system, among other things."[53]

"Nutrition researchers Sally Fallon and Kaayla Daniel of the Weston A. Price Foundation explain that bone broths contain minerals in forms that your body can easily absorb: calcium, magnesium, phosphorus, silicon, sulphur and others. They contain chondroitin sulfate and glucosamine, the compounds sold as pricey supplements to reduce inflammation, arthritis and joint pain."[54]

Bone broth supports the immune system, is an important part of restoring a leaky gut to health, reduces inflammation, boosts detoxification and the metabolism of nutrients, supports the brain, muscles, and ligaments. Bone broth also contains Glycosaminoglycans (GAG), glucosamine, hyaluronic acid, chondroitin sulfate, minerals, amino acids, electrolytes, collagen. "Collagen/gelatin and the amino acids proline, glutamine and arginine help seal these openings in the gut lining and support gut integrity."[54]

"It was Dr. Pottenger who pointed out that stock is also of great value because it supplies hydrophilic colloids to the diet. Raw food compounds are colloidal and tend to be hydrophilic, meaning that they attract liquids. Thus, when we eat a salad or some other raw food, the hydrophilic colloids attract digestive juices for rapid and effective digestion. Colloids that have been heated are generally hydrophobic – they repel liquids, making cooked foods harder to digest. However, the proteinaceous gelatin in meat broths has the unusual property of attracting liquids – it is hydrophilic – even after it has been heated."[55]

Sally Fallon of the Weston A. Price Foundation states that "most store-bought 'stock' and 'broth' today aren't 'REAL.'" Instead, companies use lab-produced meat flavors in bouillon cubes, soup and sauce mixes. Also, manufacturers began using monosodium glutamate (MSG), which is recognized as a meat flavor but in reality, is a neurotoxin."[56]

Your own homemade broth is simple to make and more nutritious than any available for purchase in a store. Bone broth is rich in calcium, magnesium, and phosphorus along with amino acid-containing gelatin. Additional nutrients are iron, the vitamins A and K, fatty acids, and the minerals selenium, zinc, and manganese. Contains the amino acid glutamine.

Gelatin is beneficial for the joints and bone broth can be helpful to people who suffer from osteoarthritis as it reduces inflammation. Is healing to the intestines, improves sleep, and supports weight loss.

COLLAGEN HYDROLYSATE & GELATIN

"The degenerative and inflammatory diseases can often be corrected by the use of gelatin-rich foods."

~ Ray Peat, Ph.D.[57]

Collagen, the uncooked form of gelatin, is a type of protein that is very abundant in the human body containing 29 percent of the amino acid glycine as a primary building block. Not only does collagen make strong, healthy hair and nails, it restores young-looking skin. It is also beneficial to correct degenerative and inflammatory diseases like diabetes, arthritis – notably rheumatoid arthritis, cancer, and as we will discuss in just a moment, collagen is crucially important in thyroid health.

"The amino acids cysteine and tryptophan, released in large quantities during stress, have antimetabolic (thyroid-suppressing) and, eventually, toxic effects. Hypothyroidism itself increases the catabolic turnover of protein, even though general metabolism is slowed."[57] Modern-day industrialized society consumes very little gelatin. Conversely, the 'Standard American Diet' is made up primarily of the amino acids tryptophan and cysteine, which are thyroid suppressants.

Collagen can help lower cortisol levels in the blood by increasing the liver's ability to convert thyroid hormone into active T3.[58]

"Gelatin acts first and foremost as an aid to digestion and has been used successfully in the treatment of many intestinal disorders, including hyperacidity, colitis, and Crohn's disease. Although gelatin is by no means a complete protein, containing only the amino acids arginine and glycine in large amounts, it acts as a protein sparer, allowing the body to more fully utilize the complete proteins that are taken in. Thus, gelatin-rich broths are a must for those who cannot afford large amounts of meat in their diets. Gelatin also seems to be of use in the treatment of many chronic disorders, including anemia and other diseases of the blood, diabetes, muscular dystrophy and even cancer."[59]

COLOSTRUM

Colostrum is life's first food. Although not technically a glandular, it works in a similar fashion. It contains "proteins, carbohydrates, fats, vitamins, minerals, and proteins (antibodies) that fight disease causing agents such as bacteria and viruses. Antibody levels in colostrums can be 100 times higher than levels in regular cow's milk."[60] Colostrum contains the antibodies for C. parvum which is a common parasite found in drinking water.

Colostrum can be used to stimulate the immune system and repair the gut, to reduce rotaviral diarrhea and HIV-related diarrhea. It also can be effective in adults and children with a history of infectious diarrhea although it does not appear to be effective when taken concurrently with antibiotics. Taking oral bovine colostrum for 8 weeks may be an effective flu preventative, including in those who have already received a flu vaccination and in heart disease patients who are at high risk. It may be considered for autoimmune issues, muscular-skeletal and cartilage repair and growth, as well as wound healing especially for trauma and surgical patients.[61]

Colostrum is being used to increase athletic performance, counter muscle loss in the elderly (seems to benefit leg strength, but not upper body strength), reducing levels of blood sugar following a meal as well as cholesterol levels in those with type 2 diabetes, to increase weight (but not height) in young children exhibiting 'failure to thrive', colitis, human papilloma virus (HPV), upper airway infection, bacterial and fungal infections, etc.[62]

Contraindications: Those allergic to cow's milk or dairy products may also be allergic to bovine colostrum.

GLANDULARS

"A gland is a secretory organ. The body's internal secretory organs are called endocrine glands. These ductless glands secrete hormones directly into the blood stream. The glands that have endocrine function include the pineal, pituitary, thyroid, parathyroid, thymus, adrenal, pancreas, and gonads (testes or ovaries). Although other organs of the body are not technically glands, it is common to refer to them as glandulars when they are used in glandular therapy. For example, tissue extracts of heart, spleen, prostate, uterus, brain, and other tissues are often used in glandular or organotherapy."[63]

Glandulars or "protomorphogens" are the salt extracts (mineral substrate) of mammalian gland tissue used to balance body chemistry and for regeneration of organs. They are generally

derived from bovine (cow) or ovine (sheep) tissues and appear to work on the Homeopathic principle of "like cures like." (e.g. If one has chronic lung issues, the lung glandular would be selected.)

There is little scientific evidence regarding how glandulars work, but it is known that they contain enzymes, peptides, nucleotides, and very small amounts of hormones along with actual tissue. However, there may also be unidentified nutrients, proteins, and other factors in them. Radioactive studies have found that the ingested glandular then concentrates in the same organ within the human test subjects as the ingested gland or organ.[64]

New Zealand-sourced glandulars are the best in the world as the animal husbandry regulations are very strict, the process is very clean, and there is comparatively little air pollution. Very low dose (Homeopathic) glandulars are available, however, they do not seem to work as well as lyophilized (freeze-dried) glandulars. Desiccated glandulars should be avoided as they have been dried at very high temperatures that destroy the enzymes.

While some individuals need them for a short-time, others may need to take them for years and it is safe to do so. Glandulars are typically taken on an empty stomach between meals unless otherwise indicated. The dose for adults is 1 or 2 tablets/capsules, 2 to 3 times per day. The dose should be increased for those who are significantly heavier. Digestive upset is a rare occurrence. The remedy would be to take the glandulars with a small amount of food.

Adrenal

Adrenal glandulars may be useful in cases of chronic fatigue or when someone is consistently tired in the morning, has exercise-induced or stress-induced asthma, headaches, or when there is an abnormal craving for salt. It should be also be considered when there is an issue with the body's production of corticosteroids (hormone-related compounds that are anti-inflammatory and potentially analgesic.

Potentially helpful in chronic inflammatory-type illnesses such as rheumatoid arthritis, ulcerative colitis, Lyme disease, and lupus as adrenal glandulars assist in keeping inflammation to a minimum by reducing the production of stress hormones. Adrenal glandulars are best taken with meals.

Favorable adrenal function is a prerequisite for optimum health. Glandulars are supportive in the healing process of the adrenals, however, the client must learn effective methods to work through their perceived stressors. The body simply cannot continue in the alarm stage of the General Adaptation Syndrome without further deterioration. Regular exercise is one of the best ways to increase the body's ability to process stress.

Aorta

This remarkable glandular has proven useful in diseases of the blood vessels such as: arteriosclerosis, varicose veins, hemorrhoids, and strokes. Aorta glandular increases blood flow as it works to support the structural integrity of both the arteries and the veins. This can be seen in improved blood flow to the brain, hands, and feet. Vascular insufficiency can be recognized by symptoms such as: short-term memory loss, vertigo, headache, depression,

ringing in the ears, cold hands and feet, pain, muscle cramps, and impotence. Many of these symptoms are commonly seen as signs of aging.

For support of the cardiovascular/circulatory system. Aorta may be included in heart or "cardio" glandulars.

Bladder

Goat bladder is generally where this tissue is sourced. It supports the bladder with the proteins, enzymes and peptides it requires. Urethra should be included as it contains the fibers that sense when the bladder has stretched and needs to be emptied.

Bone Marrow

Bone marrow is the site of new blood cell production and contains stem cells which have been transformed into neural cells. The marrow is also useful in inflammatory bowel disease. Bone marrow glandular should be considered in instances of anemias, blood cancers such as leukemia and lymphoma, sickle cell anemia, infections, and other diseases related to the function of bone marrow. It may also benefit inflammatory bowel disease.

Bone (Osseous)

The hard, exterior bone tissue is called Osseous. Apatite is a calcium component of tooth enamel and also included in some bone glandulars. Glandulars such as Osseous/Apatite may be helpful for prevention and for diseases that are located in the hardened areas of the bone such as: osteoporosis, osteopenia, osteomyelitis, osteomalacia, ankylosing spondylitis, Paget's disease, arthritis, bone infections, fractures, skeletal fluorosis, tumors, bone cancers, rebuilding tooth enamel, etc.

Brain

Brain glandular can be beneficial when working with those suffering from different types of dementia and Alzheimer's disease. It would also be suitable for stroke damage and is sometimes used to support anti-aging.

Heart/Cardiovascular

CoQ10 (see Antioxidants chapter) was initially derived from bovine heart tissue. It is valuable for chronic heart disease of all types as it improves circulation while being supportive of the cardiovascular system. Often used for better athletic performance, muscular weakness, fatigue without exertion, or when in need of increased energy or endurance. It is beneficial to those who are frequently cold, and in cases of low blood pressure. Heart tissue extract has also been used to support glucose uptake and in ATP production.

Heart glandular can be stimulating so it should be taken earlier in the day (at lunch or before) so as not to interfere sleep.

Hypothalamus

This supplement may be found combined with Pituitary adrenal as well. The Hypothalamus sends signals to the pituitary and thyroid. Therefore, combining this glandular with an adrenal glandular would be appropriate. It may be used in instances when the hypothalamic-pituitary-adrenal (HPA) axis is unbalanced. Additionally, the hypothalamus makes oxytocin which is a hormone involved in milk secretion and the flexibility of the uterus.

Types of ailments that may benefit from a hypothalamus glandular would be chronic fatigue, temperature dysregulation, glucose regulation, endocrine imbalances (including those from drug abuse or extreme weight changes), tumors in the brain, meningitis, or any severe illness. Hypothalamus can be beneficial when a person's emotions are imbalanced and there is an over-response to stress, when a person is in need of calming (to restore tranquility), or as mood enhancer.

Kidney

Up until the 1950's eating organ meats such as liver and kidney was very common as most people understood that consuming organs was beneficial to their health. Kidney glandulars are useful to not only strengthen already healthy kidneys but are useful in all manner of kidney diseases and conditions.

Liver

Especially useful for supporting the liver in its attempt to detoxify as it supports a healthy liver, metabolism, and lymphatic system, as the liver is the chemical factory of the body. Some sage advice passed down to the budding wellness professional… "If you don't know what to do, treat the liver." and… "If you support the liver, it helps everything else in the body work better." - Robert J. Thiel, Ph.D.

You may consider liver extracts in cases of chronic liver diseases, degenerative disease of any kind, hepatitis (especially when the liver is struggling in conjugating vitamins), enlarged liver, anemia, fatigue, sluggish metabolism, etc. Even as early as the 1600s consumption of liver was known to remedy night blindness. Liver glandular is by far the best form of heme iron for the body.

Contraindications: Those who have an iron-storage disorder such as hemochromatosis should not consume liver glandulars.

Lung (Pneumo)

Worth considering for respiratory and lung health, lung glandular is helpful when there are concerns about lung health such as chronic bronchitis, emphysema, coughs, chest colds, pneumonia, asthma, and adrenal insufficiency, etc. Lung glandular can be used effectively whenever pulmonary support is needed including accidental dust or fumes inhalation or even when convalescing from respiratory ailments or any time when the lungs need support.

Lymph
(Also see Thymus.) Lymph gland is often combined with thymus gland glandular and may be helpful for a weak immune system evidenced by frequent colds and flu.

Mammary
Breast tissues in males and females consist of glandular, connective, and fat tissues. Breast tissue enlargement occurs in response to increasing levels of estrogen in the body. Lactation occurs due to the release of prolactin and the decrease of progesterone during pregnancy and after childbirth.

It would be appropriate to consider mammary glandular tissue when there are breast concerns due to a hormone imbalance, lactation difficulties, and as breast tissue begins to degenerate during menopause. It is an interesting side note that cows do not get breast cancer.

Ovary
The ovaries are important in female hormone production and ovulation. Ovarian glandular can be used as a support to promote hormonal growth and development during adolescence and throughout life. It may be beneficial for women with low libido, decline of ovarian function, infertility, ovarian cysts (and symptoms), female pattern hair loss, and other issues. It is also helpful for sleep and regulating mood (typically PMS) and reducing the symptoms of menopause such as hot flashes, cramps, or mood swings.

Pancreas
The pancreas is important in that it secretes enzymes that reduce the size of food particles for assimilation in the small intestine making it a beneficial glandular for those with digestion-related ailments such as: grain-related indigestion, gluten intolerance, celiac disease, and digestion of fats, proteins and carbohydrates. The pancreas is also significant in that it makes the hormones insulin and glucagon which control blood glucose levels.

Glandular from bovine pancreas helps to feed and rebuild the pancreas making it a good choice for those with poor digestion and blood sugar issues. It would also be appropriate for Diabetes type II. It has also been found to be helpful in very high doses for some cancers.

Pituitary
The pituitary gland controls the hormones that affect growth as well as other gland-related hormonal functions in the body. Pituitary disorders are generally those that have too much or too little of a particular hormone. A good endocrine or pituitary glandular complex ought to include pituitary tissue as it is useful for supporting the body through the pituitary by balancing hormones. Pituitary glandular is also beneficial for supporting an injured pituitary or one with a tumor.

Spleen

The spleen makes white blood cells and is responsible for destroying bacteria and microbes as it filters blood cells. Additionally, the spleen produces tuftsin and splenopentin, two compounds that boost immunity. A spleen glandular would be useful when there are immune issues related to the spleen being removed. It should also be considered as a remedial for autoimmune issues, specifically in autoimmune disorders such as lupus rheumatoid arthritis, ulcerative colitis, and celiac disease. It can also benefit lymphatic issues and swelling of the lymph nodes, allergic reactions such as hives, or canker and cold sores, propensity towards infections and boils, blood issues such as anemia or lymphocytosis, toxicity, and narcolepsy. Think of spleen glandular as a lymphatic organ support when the system is already overtaxed or has potential to become so during the healing process.

Testes (Orchic)

Typically derived from bovine (bull) testicles, testicular glandular works to increase testosterone, sexual performance, and sperm health in men. It is also beneficial for male infertility and (male and in certain circumstances female) mood enhancement.

Thymus (Lymph)

Those who may benefit from a thymus glandular would likely show signs of a weak immune system such as frequent colds and flu, staph, strep, or other bacterial issues, chronic or recurring viral infections, chronic fatigue syndrome, or for prevention of recurrent respiratory infections in pregnancy and in young children. It can be recommended in instances of hyperglandular conditions such as hyperthyroid, hyperadrenal, etc.

The thymus gland produces T-Lymphocytes which function as part of the lymphatic system. A missing or malfunctioning thymus can cause a child to be especially vulnerable to infections or developmental disorders.[65] Some people take Thymus glandular during the cold and flu season just to boost the immune system's production of T-Lymphocytes. Thymus glandular can also be used to help autoimmune conditions such as rheumatoid arthritis or HIV/AIDS, cancer, allergies, migraine headaches, rheumatoid arthritis, skin conditions such as eczema, and hepatitis B and/or C.

"Recurrent or chronic infections, including the so-called "chronic fatigue syndrome" and "chronic post-viral syndrome," are characterized by a depressed immune system. What makes it difficult for people to overcome these illnesses is the repetitive cycle – a compromised immune system leads to infection; infection leads to a damaged immune system, further weakening resistance. Thymus extracts may provide the answer to chronic infections by restoring healthy immune function.

Researchers studied the ability of thymus extracts to treat and then reduce the number of recurrent infections in groups of children with a history of recurrent respiratory tract infections. Double-blind studies reveal that orally administered thymus extracts are not only able to effectively eliminate infection, but that treatment over the course of a year significantly reduces the number of respiratory infections and significantly improves numerous immune parameters."[66]

Thyroid

Pharmaceutical thyroid products overwhelm the thyroid with hormones whereas a thyroid glandular 'feeds' the thyroid and has a very low hormonal effect.

Thyroid glandular is useful for mild, underactive thyroid conditions. It can also be helpful for those who are extremely overweight, or who suffer from PMS, headaches before menstruation, and for women who feel a bit "off" a few days each month.

Uterus

Uterus glandular can be used for uterine concerns: excessive menstrual flow, to strengthen/feed the uterus in the last weeks/month of pregnancy to help with delivery and the uterus regressing to normal size after pregnancy (and perhaps the first month after delivery), for postpartum depression, mood issues, heavy cycles, and for women who have had hysterectomies.

Additional glandulars include: Medulla/Myelin contain nerves and brain stem which may be beneficial for CNS conditions such as but not limited to multiple sclerosis. Prostate glandular is considered helpful for the prevention and treatment of prostate disorders, and so forth.

Glandular complexes contain multiple glandulars designed to support entire systems such as the endocrine system, the HPA axis, the pancreas, etc. Glandular complexes may be included in organ supportive herbal formulas.

OX BILE

While unnecessary for those in good digestive health, ox bile is necessary for those who have had their gallbladders removed or whose gallbladders and/or livers are not functioning efficiently. Liver disease may cause insufficient bile production. When people develop fatty liver, or pass consistently fatty stools (they float), ox bile can emulsify and reduce the amount of undigested fat in the GI tract.

The first order of attention should be given to the client's diet. They should not consume hydrogenated/trans fatty acids. If frequent stomach upset occurs, pancreatic insufficiency (low lipase production) could be an issue. Whenever there is a disorder of the small intestine, the gallbladder or the liver does not produce the bile necessary for proper digestion of dietary fat, ox bile should be considered.

Consider malnutrition when bile is not secreted sufficiently. People become low in fat-soluble vitamins A, D, E, and K as adequate bile secretion is necessary to extract these food nutrients as well as the essential fatty acids such as Omega-3s. Bile helps keep fat from accumulating in the liver and also keeps gut microbes balanced. An imbalanced gut microbiome can also cause bile insufficiency. Bile also serves to lubricate the colon which helps with the removal of toxins and to eliminate excess cholesterol.

Warnings: Do not take ox bile during bouts of diarrhea. Excess Ox bile supplements can cause diarrhea and abdominal pain.

ANTIOXIDANTS

The body takes in air and food nutrients and metabolizes them into chemically-based energy. The waste products are atomic chemical structures designed to have a pair of electrons but have lost one in the process of metabolization. Now they are called 'free radicals.'

This pairing design causes free radicals to search for another electron to fill the gap. This is where free radicals become associated with rapid aging and disease. Free radicals help themselves to electrons from other molecules (called oxidation) and by doing so weaken and damage those cellular structures until there is systemic inflammation, organ damage, tumor growth, etc.

The work of "anti"-oxidants (one might think of them as "buddies for radicals") is to protect the body from this cellular oxidative damage by free radicals. While the body makes some of its own antioxidants, it tends to make less as we age. In an increasingly toxic world, depleted soil that cannot produce high-quality nutrient-filled foods, poor food choices, nutrient deficiencies, various states of disease progression and the like, it seems as though antioxidant supplements should be the first order of business.

Yet the word of the day is moderation, especially in the case of antioxidants. There are specific antioxidants designed to combat different free radicals, therefore the place to start is with a diet that can boost those antioxidant levels by eating normal-sized servings of a variety of fruits and vegetables each day. Variety is the key word! Additionally, avoid sugar, grains, fast foods, and processed foods, and also eliminate the toxins including radiation from your environment as much as possible.

Most people even if they tried, could not possibly eat themselves into a predicament where they consumed harmful mega-doses of antioxidants. There is some evidence that "suggests that when taken in megadoses, antioxidants can become pro-oxidants, which increase the production of free radicals, especially in people who smoke or drink alcohol."[67] This is called 'antioxidant stress'.

It is best to remember that antioxidants by nature come in food sources. By design they work in synergy with all of the factors involved in a healthy, balanced diet. Synthetic and/or isolated compounds are not balanced when entering the body. Therefore, wisdom should be exercised when recommending antioxidants. Food-based and herbal antioxidant formulas in moderation are much safer for short or long-term use, while synthetic and/or isolated compounds should be used short-term and mega-dosing should be avoided.

The body will use free radicals to fight diseases such as cancer and chronic disease yet there are two "keys" to this puzzle. One is moderation and the other is non-isolation. When larger doses may be necessary, keep the length of time period short and make sure nutrition is balanced.

The synergy with which antioxidants work together is a design to ponder. For example, we know that "vitamin C recycles vitamin E. Once a molecule of vitamin E neutralizes a free radical, vitamin C converts that molecule of E back to its antioxidant form, allowing it to combat more free radicals. 'So if you take a lot of vitamin E but your vitamin C intake is low, you won't see much antioxidant benefit".[67]

The same rings true for selenium and CoQ10. Boost the effects of both by taking them together. This does not always mean an additional selenium supplement is required, rather that CoQ10 is taken with a supplement (or food) that contains selenium (i.e., many multivitamins, brazil nuts, etc.) Additionally, the most optimal effects occur when using CoQ10, vitamin E and Selenium together as Selenium is part of glutathione peroxidase, an enzyme that works in an antioxidant manner.

Signs of Oxidative Stress

- Atherosclerosis
- Brain Fog
- Cancer
- Cataracts, Eye Diseases
- Chronic Disease
- Colds & Flu
- Decreased Immunity
- Fatigue
- Gray Hair
- Headaches
- Heart Disease
- Hypertension
- Joint Pain
- Memory Loss
- Muscle Pain
- Noise Sensitivity
- Susceptibility to Infections
- Vision Trouble
- Wrinkles

Food sources of antioxidants include sprouted grains, legumes, many fresh fruits including acai berries, blueberries, grapes, gogi berries, etc., dark chocolate, pecans, artichoke, and other fresh vegetables. Antioxidant spices include clove, cinnamon, ginger, oregano, chili pepper, black pepper, mustard, paprika, turmeric, curry, basil, parsley, and cocoa.

While some antioxidants can be obtained in foods it is difficult to ingest sufficient quantities. This makes supplementation necessary to minimize the damage caused by free radicals. Nutrients that perform as antioxidants include vitamin A, beta carotene, vitamin C, vitamin E, selenium, and zinc. Specifics about vitamins and minerals are covered in the paragraphs above or in their respective manuals. The antioxidants listed below are others that are significant and worthy of mention.

Alpha-Lipoic Acid (ALA or Lipoic Acid)

This antioxidant helps to stabilize blood sugar by converting glucose to energy. It is anti-inflammatory, increases the antioxidant abilities of vitamins C and E, and boosts glutathione which aids in detoxification.

Food Sources include bovine organ meats (kidney, heart, liver), brewer's yeast, spinach, Brussels sprouts, broccoli, collards, Swiss chard, peas, rice bran/brown rice, and tomato.

Beta-Carotene

Beta-Carotene is also known as pro-vitamin A. It is the yellow and orange colors in fruits and vegetables. Inside the body beta-carotene is converted into vitamin A which is a powerful antioxidant supporting neurological function and vision health. Studies have shown that isolated, synthetic beta-carotene can increase heart disease and the growth of lung and stomach cancers in smokers and asbestos laborers.[68]

Various isolates of beta-carotene become crystalline in structure and are not recognizable as food to the body although they may raise serum vitamin A levels in a similar manner. As Dr. Thiel asserts, "In my opinion, betacarotene in carrots, however, is safer than even Dr. Sinatra suggests (there is about 12,000 i.u. of betacarotene in one raw carrot). The reason for this is because betacarotene in carrots is attached to lipoproteins which appear to aid in preventing toxicity. Isolated USP betacarotene, even if it allegedly comes from 'natural' sources, simply does not have the attached lipoproteins or other potentially protective substances found in foods like carrots."[69]

One power-packed average size carrot contains more than the RDA for vitamin A; therefore, it is not difficult for most people to obtain what the body needs each day. Exceptions would be those who have been on long-term low-fat diets and deficiencies caused by malabsorption. It is recommended that water-dispersible beta-carotene be used when a supplement is selected as there is less risk of the occurrence of overdose.

Food Sources: Leafy greens, sweet potato tubers and leaves, spinach, chard, turnip greens, carrots, pumpkins, squash, cantaloupe, mano, goji berries, butter, egg yolk, palm oil, and liver.

Coenzyme Q10 (CoQ10)

Coenzyme Q10 (CoQ10) provides a nourishing foundation for cellular energy which results in improved mitochondrial function. As people age, they do not produce enough CoQ10 to sustain their body's energy requirements. The result is accelerated aging and degenerative disease.

CoQ10 is a powerful neutralizer of free radicals that notably improves circulation in the body and as such is beneficial for the cardiovascular system. "In Japan, Italy, Sweden, Denmark, Israel, and Canada, CoQ10 is treated as a prescription drug, and is widely prescribed by physicians to treat congestive heart failure."[70] Coenzyme Q10 also stimulates the immune system, and increases collagen and elastin in the skin.

Studies have shown improvements with CoQ10 only, however, when it is combined with shilajit (see TERRA FIRMA: **Shilajit**) there is an even greater enhancement of the ability of the mitochondria to convert food into energy. Additionally, this cellular energy or ATP (adenosine triphosphate) is increasingly available to body tissues. While CoQ10 is quickly depleted in the body, shilajit "has been found to stabilize, revitalize, and preserve CoQ10 in its active (*ubiquinol*) form, boosting the levels of CoQ10 critical for protection against mitochondrial aging.

When used along with CoQ10, the combination [of CoQ10 and shilajit] produces benefits above and beyond what each nutrient offers individually, providing a powerful *synergistic* effect that

boosts energy, protects mitochondria, and reduces aging at the cellular level."[71][*my clarification*]

Food Sources of CoQ10 are beef, poultry, peanuts, sesame seeds, pistachios, broccoli, cauliflower, oranges, and strawberries.

Cysteine

As an antioxidant Cysteine is one of the three amino acids necessary to produce glutathione. It is "used by the liver and the lymphocytes to detoxify chemicals and other poisons. It is a powerful detoxifier of alcohol, tobacco smoke, and environmental pollutants all of which are immune suppressors."[71]

Contraindications: High doses of Cysteine (over 1,000 mgs/day) may be toxic. Cysteine and its supplemental forms are capable of inactivating insulin; therefore, diabetics should use caution when supplementing. Those whose kidneys form the cystine form of kidney stones (cystinuria) should not supplement cysteine. Digestive upset and/or nausea are possible but not common side-effects.

N-Acetylcysteine (NAC)

NAC, a supplemental form of cysteine may be used in place of L-Cysteine to increase glutathione levels in the body especially in the lungs, kidneys, liver, and bone marrow making it a powerful antioxidant. It is preferable to supplement NAC than oral glutathione which has not been found to be particularly stable. NAC is metabolized to cysteine and then glutathione. (see AMINO ACIDS: **N-Acetylcysteine (NAC)**

Glutathione (GSH)

In the body, every cell makes and uses glutathione. It is a combination of the amino acids cysteine, glycine, and glutamine which together function as Glutathione, an immune-building-organ-protecting antioxidant, free-radical destroyer, and a detoxifier of humanity!

Glutathione as an immune-regulator works by producing leukotrienes which block the production of inflammatory cytokines which keep people with chronic health issues in a constant state of low-grade inflammation. Excessive inflammation is causative for quite a number of lung diseases. Increasing glutathione to a healthy level can support the body in its recovery.

Free radicals are unstable atoms that create cellular damage in their quest to become 'stable,' thereby weakening cells and the structures they compose such as the brain, gut, liver, kidneys, heart, and lungs. Free radical destabilization results in illness and the aging process. In its function as a 'protector of organs,' Glutathione works to neutralize free-radicals by donating the electron they need to become stable. In this way, the free radical's "arms" are full and it cannot take from the body and further destabilize cells and organs.

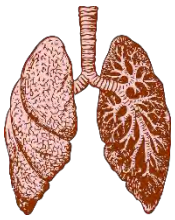
As a detoxifier Glutathione prevents environmental toxins from damage at the cellular level. The largest quantity of the body's Glutathione is stored in the liver. There it helps the liver

detoxify fats releasing destructive compounds which are carried out of the liver (and ultimately the body) through the bile taking the stress off of the gallbladder. “Glutathione is critical for the detoxification of carcinogens such as benzene (commonly found in automotive exhaust), heavy metals such as mercury, cadmium and lead, and common chemicals such as BPA. Remember also, that if there is an increased exposure to environmental chemicals, the demand for glutathione synthesis increases.”[72]

Common Uses of Glutathione

- Accelerated Aging
- AIDS
- Balance (difficulty maintaining)
- Brain “Fog”
- Depression
- Dizziness
- Dry Skin
- Fatigue
- Frequent Colds
- Headaches
- Impaired Carbohydrate Metabolism
- Inability or Reduced Ability to Detoxify
- Mental Disorders
- Joint Pain
- Lack of Coordination
- Rashes
- Sleep Disorders
- Tremors
- Weakness

Lung Diseases Associated with Glutathione Deficiency[73]



- Acute Lung Injury/Acute Respiratory Distress Syndrome
- Chronic Bronchitis
- Chronic Obstructive Pulmonary Disease
- Cystic Fibrosis
- Idiopathic Pulmonary Fibrosis
- Various Bacteria & Viral Infections
- Toxicity of Various Foreign Compounds (smoke, pollutants, drugs, asbestos, silica, etc.)

There is a debate over the effectivity of oral supplementation of glutathione. Many natural health professionals prefer to assist the body by supplying the raw nutrients it needs to make Glutathione.

Food sources containing glutathione are: meats, dairy, and eggs, “asparagus, potatoes, peppers, carrots, onion, broccoli, avocados, squash, spinach, garlic, tomatoes, grapefruit, apples, oranges, peaches, bananas, and melons.”[74]

Para-Aminobenzoic Acid (PABA)

Para-Aminobenzoic Acid functions as an antioxidant and thought by some to be vitamin Bx, a part of the B-complex vitamin folate. It helps the body to metabolize vitamin B5 (pantothenic acid.)

PABA is necessary for heathy skin and hair pigmentation. If the graying was due to stress or B vitamin deficiency, PABA may restore gray hair to the original color when supplemented along with inositol, folic acid, and vitamin B5.

Long-term antibiotic use and sulfa drugs negatively affect the bacteria in the intestinal tract that produce PABA. Supplementing with small doses is best. PABA is often included in vitamin B complexes and multi-vitamins.

PABA Deficiency

- Chronic Constipation
- Depression
- Eczema (weeping or moist)
- Fatigue
- GI Tract Dysfunction
- Headaches (frequent)
- Irritability
- Nervousness
- Restore Premature Gray Hair
- Vitiligo
- Wrinkles (premature)

Food sources of PABA include organ meats (liver & kidney), wheat germ, brewer's yeast, mushrooms, spinach, whole grains, and molasses.

Contraindications: High doses of PABA, may cause fever, nausea/vomiting, diarrhea, breathing difficulties, skin rashes, low blood glucose, liver failure, and coma. It is safe to use in small doses.

Standardized Milk Thistle (Silybum)

Milk Thistle (*Silybum marianum*) is an herbal remedial known to have antiviral, anti-inflammatory, anticarcinogenic, cholagogue, cholesterol-balancing, demulcent, galactagogue, hepatoprotective, immunostimulating, (possibly estrogenic), and antioxidant actions. It is best known as a liver and kidney regenerator, restorer, and protector. Milk thistle can detoxify synthetic chemicals, acetaminophen, heavy metals, alcohol, and even radiation.

The known active ingredient in Milk Thistle is called Silymarin. Silymarin is a complex of antioxidants with an affinity for the liver and is ten times more potent than vitamin E. Most standardized herbs have approximately 80 percent silymarin. It is recommended to use standardized milk thistle to support changes in the body and not simply for maintenance.

Milk thistle is common in the treatment of both alcoholic and nonalcoholic fatty liver disease, liver cirrhosis, viral hepatitis, alcoholic hepatitis, and liver poisoning. It is also a fixer of gallbladder disorders. Other disorders benefitted by milk thistle are adrenal disorders, alcohol and drug addiction recovery, constipation, depression, diabetes (for blood sugar control), hormone imbalance, IBS, indigestion, psoriasis and other skin conditions (because it increases the flow of bile), food and environmental allergies, and candida.

Warning: Those with prostate cancer should not take milk thistle. Milk thistle may have negative effects for those that consume alcohol chronically. Should digestive irritation occur, take with food.

Quercetin

The most common flavonoid, Quercetin is an antioxidant derived from "superfoods" with brightly-colored plant pigments. It is useful in situations such as during chronic periods of sleep debt, high stress situations, when diet is poor, and as a result of chronic or acute exposure to chemical toxins.

Quercetin is helpful for combating free-radical damage and therefore, aging and inflammation. Inflammatory conditions where quercetin is helpful are: allergies, asthma, autoimmune disorders such as Rheumatoid arthritis, bursitis, cancer prevention and treatment, cataracts, chronic fatigue, Crohn's, histamine (it inhibits release), infections, IBS, leaky gut, prostatitis, ulcers (inhibits *H. pylori*), heart disease, and corresponding blood vessel problems.

Quercetin has also been shown to boost the activity of Vitamin C in the body. It is "further thought to decrease the infectiousness of certain RNA and DNA viruses, such as herpes, polio, and Epstein-Barr, by inhibiting their replication. It may also be helpful in preventing eye and nerve damage in diabetics by decreasing tissue irritation."[75]

The inflammatory conditions related to diabetes are benefitted by Quercetin. The flavonoids in antioxidants, especially Quercetin, have demonstrably inhibited the development of diabetic cataracts, neuropathy, and retinopathy.

To have any reasonable expectations from the anti-inflammatory benefits of Quercetin, the client must be made aware that the assault of all sugars, (including sugars derived from the breakdown of carbohydrates) must be quelled. Food sources, although beneficial under normal circumstances, will not be sufficient to reverse diabetic complications.

Food sources of quercetin include apples, Chinese cabbage, green tea, kale, blueberries, onions, turnips, red wine, and other brightly-colored nutrient-dense fruits and vegetables, nuts and seeds. Herb sources of quercetin include St. Johnswort and Gingko Biloba. Studies have revealed quercetin to be anti-inflammatory, anti-allergenic, anti-microbial, antiviral, and anti-carcinogenic.

~ Aldose Reductase

Aldose Reductase is an enzyme that primarily converts glucose to sorbitol, the first of two steps in the pathway of glucose metabolism. Under normal glycemic conditions only a small portion of glucose is metabolized through this pathway, however in diabetics, chronic hyperglycemia (high blood sugar) causes the response of Aldose Reductase to accelerate.

continued…

Aldose Reductase continued.

Current theory holds Aldose Reductase as the responsible mechanism behind diabetic complications caused by hyperglycemia. The conversion process initiated by aldose reductase depletes the body (specifically these tissues subject to diabetic complications) of nutrients: amino acids, vitamins, and minerals. As Aldose Reductase breaks down glucose into sorbitol, inflammation occurs in these tissues which further degrade into what we see as diabetic complications.

Sorbitol is "osmotically active, drawing water into cells, which causes these cells to swell. This can eventually result in serious complications such as sorbitol diabetic neuropathy and other issues diabetics should be aware of: Vision problems (retinopathy), Kidney problems (nephropathy), Blood vessel damage."[76]

S-adenosylmethionine (SAMe)

SAMe is a molecule produced in each cell during the methylation cycle. It actually becomes the amino acid methionine when it is partially converted to cysteine. When there is ample vitamin B6 present this molecule can further convert into cysteine. From here cysteine can be used by the body to produce glutathione. It is actually this methylation cycle that is the primary source of intracellular cysteine in our bodies.

~ Methylation

Very simplified, methylation is the biochemical process of regulating activity in the body. This occurs when four atoms (one carbon atom and three hydrogen atoms – CH3) are transferred from one substance to another.

"When optimal methylation occurs, it has a significant positive impact on many biochemical reactions in the body that regulate the activity of the cardiovascular, neurological, reproductive, and detoxification systems, including those relating to: DNA production, neurotransmitter production, detoxification, histamine metabolism, estrogen metabolism, eye health, fat metabolism, cellular energy, and liver health."[78]

SAMe can also transform into homocysteine which occurs when there are deficiencies in folic acid and vitamins B6 and B12, whether from suboptimal intake or malabsorption. If there is no deficiency the body will have enough resources to convert homocysteine back into methionine.

"All homocysteine in the body is biosynthesized from methionine, an essential amino acid found abundantly in meats, seafood, dairy products, and eggs. Vegetables, with few exceptions (e.g., sesame seeds and Brazil nuts), are low in methionine; even such protein-rich

legumes as beans, peas, and lentils contain relatively small amounts of methionine compared to animal-derived foods."[77]

Diets too high in protein produce too much homocysteine from the methionine found in those sources. Homocysteine is then carried in the blood increasing the risk of cardiovascular problems such as heart attack, stroke, atherosclerosis, and increased blood clotting. Additionally, it is known that homocysteine is involved in plaque buildup in blood vessels to the brain causing chronic inflammation that can result in memory problems, cognitive decline, dementia, and Alzheimer's disease.

Dietary considerations for obtaining folate and vitamins B6 and B12 directly from foods would entail eating more vegetables such as spinach and sulfur-based cruciferous vegetables such as kale, spinach, broccoli, and cauliflower.

SAMe, a prescription medication in Europe, is commonly prescribed in depressive disorders, osteoarthritis, and liver disease. It is necessary to build the hormones dopamine, serotonin, and GABA as well as the neurotransmitter acetyl-choline, important in healthy cognitive function and increased memory capabilities.

Additionally, SAMe is beneficial for cellular metabolism, brain and liver health, fibromyalgia, and in the production of cartilage. It may also prove useful in addictions, ADHD, joint inflammation, and alcohol-related liver damage.

Food sources: Asparagus, avocado, broccoli, cauliflower, Brussels sprouts, green leafy veggies (kale, spinach, etc.), peas, beans, and lentils, and rice.

Contraindications: "SAMe is contraindicated for people with bipolar disorder because it is known to increase anxiety and cause mania. WebMD also warns that SAMe may not be safe for people with diabetes and Parkinson's disease. It may interact with painkillers, cough medicines, antidepressants, herbs (St. John's wort), medications that treat diabetes and Parkinson's. Since SAMe can affect blood vessels, it should be discontinued at least 2 weeks before any surgery. While no adverse effects were registered in pregnant women, it may not be safe for children and breastfeeding babies."[79]

Superoxide Dismutase (S0D)

Manganese Superoxide Dismutase (Mn SOD) is an enzyme residing in the mitochondria of each cell. Mn SOD uses its metal (manganese) to dis-"mutate" free superoxide radicals by taking two identical molecules and making two distinctly different products: hydrogen peroxide and oxygen. This is necessary because oxygen in the mitochondrial membrane can spontaneously reduce to a superoxide free radical. Without Mn SOD, superoxide radicals would build up within the mitochondria and shut down the energy-producing part of the cell.

An imbalance occurs when there are not enough antioxidants to remove the accumulation of free radicals. SOD levels tend to decline with age. The resultant damage to lipids, proteins, and nucleic acids cause inflammation that results in disease. SOD supplements in pill form must be enteric coated to bypass stomach acid and move into the intestine for absorption.

Food sources: barley grass, wheatgrass, broccoli, Brussels sprouts, cabbage, many green plants, cantaloupe, and honeydew melons.

ANTIOXIDANT OLIGOMERIC PROANTHOCYANIDINS

Oligomeric Proanthocyanidins are bioflavonoid complexes found in plant metabolites that are said to have higher antioxidant potential than even the two top antioxidants, vitamins C and E. They interact with proteins.

These flavonoids are found in grape seed extract and grape skins, pine bark extract, bilberry, black currant, black and green teas, and cranberry extract. Their actions are antioxidant, anti-cancer, anti-cataract, antidiabetic, neuroprotective, and antimicrobial. The pain-relieving ability of Proanthocyanidins is due to the suppression of the inflammasomes in macrophages.[80]

Oligomeric Proanthocyanidins have been found to be anticancer, anti-diabetic (restore endothelial function, slow the progression of diabetic retinopathy), anti-obesity, lower blood pressure, are cardioprotective, improve circulation, support kidney function, inhibit candida, *Campylobacter,* and *E. coli*, reduce LDL cholesterol by inhibiting lipid peroxidation and platelet aggregation, as well as capillary hyperpermeability. They offer liver protection, increase bone strength, brain support, boost collagen levels, etc.

Food sources: The best sources are cranberry, black elderberry, lingonberry, black chokeberry, blueberry, bilberry, rose hips (fresh) and black currant with some of the most astringent being banana, carob bean, persimmon, and quince, however, to some extent they exist in all fruits.

Most supplements are made out of grape seed proanthocyanidins as it is an inexpensive waste source from the grape-processing industry. Pine Tree Bark supplement contains oligomeric Proanthocyanidins within its chemical makeup.

Bilberry (*Vaccinium myrtillus*)

Bilberry (*Vaccinium myrtillus*) is well known for it benefit to the eyes. The fruit and leaves have an affinity for the eyes in a myriad of ways. From improved vision in general to better night vision. Bilberry retards macular degeneration, prevents cataracts, strengthens the eye's blood vessels, and prevents diabetic retinopathy. Other health benefits of bilberry are: curbing diarrhea, menstrual cramps, and it also strengthens veins which is needed with varicose veins, atherosclerosis, and chronic venous insufficiency. It boosts circulation, lowers hypertension, and is of benefit to the entire cardiovascular system. Bilberry is also anti-inflammatory and has "been used to treat chronic fatigue syndrome, hemorrhoids, diabetes, osteoarthritis, gout, skin infections, gastrointestinal disorders, kidney disease and urinary tract infections."[81]

"In glaucoma, the eyes have to deal with increased pressure. If this pressure becomes too high, it can result in blindness. Taking bilberry for eyesight helps to prevent glaucoma by increasing the production and integrity of collagen in the eyes. Collagen is a protein found in connective tissue and it also helps in capillary flexibility. Because collagen is strengthened by bilberry, the eyes are better able to withstand the pressure associated with glaucoma.

Cataracts can also be prevented by bilberry since this illness results from the weakness of the collagen matrix of the lens. Moreover, cataracts are linked to free radical damage, and being a powerful antioxidant, bilberry for eyes helps avoid the development of cataracts."[82]

Cranberry (*Vaccinium macrocarpon*)

Anti-inflammatory and antioxidant, Cranberry contains such nutrients as vitamin C and manganese. As a traditional medicine among American Indians, it was used in the treatment of kidney and bladder ailments. Today, cranberry is popular for treating urinary tract infections (UTIs).

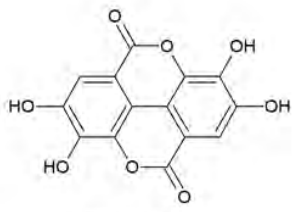
Other health benefits of cranberry juice are reduction of cholesterol, lowered blood pressure and blood sugar, and favorable effects on endothelial function and cardiometabolic health.[83]

Cranberry can be purchased in supplement form as tablets, a freeze-dried whole cranberry powder, or as a juice. When selecting a product, look for an organic, unsweetened, not-from-concentrate cranberry juice. Do not consume products with pesticides or added sugars for medicinal purposes. Cranberry fruit or juice is safe for children, and pregnant and breast-feeding mothers.

Contraindications: Cranberry contains salicylic acid and may cause a rare allergic reaction by those who are allergic to aspirin. It also contains oxalate which can form into kidney stones in individuals sensitive to oxalates. If taken in large quantities, cranberry may cause diarrhea.

Ellagic Acid

Found in fruits and vegetables, Ellagic Acid is the "phenol antioxidant dilactone of hexahydroxydiphenic acid extracted from oak galls"[84] which protects against free radicals and helps to remove toxins from the body. Ellagic acid has been found beneficial especially in reducing levels of pancreatic inflammation and fibrosis. Along these lines it has also been found beneficial in reducing fibrosis and in preventing alcoholic liver disease.[85]



Ellagic Acid

In the treatment of Chronic Lymphocytic Leukemia "Recent in vitro and in vivo experiments have revealed that EA elicits anticarcinogenic effects by inhibiting tumor cell proliferation, breaking DNA binding to carcinogens, blocking virus infection, disturbing inflammation, inducing apoptosis and angiogenesis, and drug-resistance processes required for tumor growth and metastasis"[85]

Food sources: of significant amounts of Ellagic Acid are: wild strawberries (which contain almost 10 times the amount of any other raw fruit), raspberries, blackberries, wolfberry, pomegranates, cranberries, grapes, black current, and guava. Nuts such as walnuts and pecans contain Ellagic Acid and raw chestnuts are especially high in the poly. Ox Tongue Mushroom also known as Beefsteak Fungus (Fistulina hepatica) as well as the Black Hoof mushroom (Phellinus linteus) have also been found to contain Ellagic Acid. It is also found in green tea, and in the bark and stems of Eucalyptus maculata and Eucalyptus globulus.

Ginkgo/Maidenhair Tree (*Ginkgo biloba*)

The leaves of *Ginkgo biloba* are commonly used to assist the elderly and the infirm with depression, oxygen utilization, and memory. As a remedial Gingko is also used to improve long-distance vision, retinal damage, headaches, sinusitis, vertigo, and tinnitus.

In a study of the Proanthocyanidins from *Ginkgo biloba* leaf extract, it was found that the Proanthocyanidins in Ginkgo had "potent free radical scavenging activities, which were higher than that of BHT". BHT (or Butylated hydroxytoluene) is a synthetic phenol derivative used for its antioxidant properties as a food additive to prevent oxidation. The scientists further recommended that the compounds in Gingko be investigated because of the "antioxidant effects" for medicinal uses in the treatment of "mild to moderate cognitive disorders, tinnitus, and dementia."[86]

Grape Seed Extract (GSE) (*Vitis vinifera L.*)

Grape Seed Extract (*Vitis vinifera L.*) has been found to lower blood pressure, improve circulation, support kidney function, inhibit candida, *Campylobacter*, and *E. coli*, reduce LDL cholesterol oxidation[87], aid in liver protection, bone strength, brain support, boost collagen levels, etc.

The pure extract is a highly effective antioxidant. It is unfortunate that a great portion of commercial products have been found adulterated most often with peanut skin extract, which can cause anaphylaxis in susceptible individuals. Caution should be exercised when selecting a product. GSE should not be confused with grapefruit seed extract which is a highly processed synthetic antibiotic derived from grapefruit seeds and pulp.[88]

Green Tea (*Camellia sinensis*)

Green Tea (*Camellia sinensis*) possesses 25 times the antioxidant power of vitamin E and 100 times that of vitamin C! It is known to lower cholesterol and blood pressure, assist with weight loss, regulate insulin and blood sugar, reduce risk of certain types of cancers (rectal, pancreatic, and possibly breast, prostate, stomach, and skin, etc.).

Green tea has been found to be beneficial in arthritic conditions because it is anti-inflammatory, antioxidant, antimicrobial, and it prevents the bone and cartilage loss that often occurs in arthritis.

Green tea can be purchased in powder, capsule, or tincture form, and can be taken as a tea. There is also decaffeinated green tea extract available.

Warnings: Pregnant women should avoid green tea as the caffeine it contains is likely to disrupt the growth of the developing child. Likewise, children should not drink green tea. The purpose of one Norwegian study was to look at the "association between maternal caffeine intake during pregnancy and the child's weight gain and overweight risk up to 8 years" concludes, that any "caffeine consumption during pregnancy is associated with a higher risk of excess infant growth and of childhood overweight, mainly at preschool ages. Maternal caffeine intake may modify the overall weight growth trajectory of the child from birth to 8 years."[89]

The tannins in green tea can inhibit the body's absorption of iron and also cause nausea and vomiting. Green tea should not be consumed by those with peptic ulcers. Those with the following conditions should avoid green tea: anxiety, high blood pressure, and heart, kidney, or liver problems.

Pine Bark Extract (*Pinus pinaster*) / Pycnogenol (PBE)

Pine Bark Extract (*Pinus pinaster*) is the inner bark of the Maritime Pine tree that only grows in the southwest of France. The bark of the Maritime Pine contains flavanols and bioflavonoids which are potent antioxidants that work to increase the absorption of vitamin C. Because of this, it enhances the body's ability to repair tissues and greatly reduces inflammation. Pine Bark Extract eliminates pain and inhibits clotting better than aspirin and without the side-effect of gastrointestinal bleeding. Pycnogenol is the name of the Pine Bark Extract (PBE) used in supplements.

Pine Bark Extract has been found useful for arthritis, asthma, ADHD, cancer prevention, chemotherapy, cholesterol, circulation, cirrhosis of the liver, diabetes (lowers glucose), diabetic neuropathy, diabetic ulcers, edema, endometriosis, ear health (especially toxicity of the vestibulocochlear nerve that affects balance and hearing as well as remediating ear infections), erectile dysfunction (along with L-arginine), eye health (including diabetic retinopathy and improving night vision), fertility, hemorrhoids, high blood pressure, increasing athletic performance/endurance, lupus, menopause, menstrual pain, pregnancy, skin protection/rejuvenation (photoprotective), staph infections, surgery-related lesions (hastens healing), symptoms of perimenopause, varicose veins, and weight loss.

Warnings: Although Pycnogenol has GRAS status by the FDA, rare side effects include hives and tightness of the chest/throat. PBE is not recommended with clients who are hypoglycemic or on diabetes and blood-thinning medications as Pycnogenol will bring blood sugars down and thin the blood. There may be negative interaction with immunosuppressents and certain chemotherapy drugs.

Resveratrol

Resveratrol is an antioxidant oligomeric Proanthocyanidin, anti-inflammatory compound sourced in red grapes and wine, blueberries, cranberries, and peanuts. While red wine is well-known as an important source of resveratrol, the amount it contains varies considerably. Root extracts of Japanese Knotweed (*Polygonum cuspidatum*) can provide up to 50 percent of standardized trans-resveratrol content, the very same form as is found in red wine.

Japanese knotweed is an excellent source of resveratrol as it contains high amounts of trans-resveratrol which is the active form of resveratrol most bioavailable to the body. Native to Japan, it has become an invasive plant in most other parts of the world – a veritable horticulturalist's nightmare. Yet herbalists can't stop dreaming about all the medicinal benefits of this amazing plant. In the resveratrol supplement industry it is quickly replacing red wine as it is abundant and already in the form the body needs without having to convert it.

The benefits of resveratrol include anti-aging, brain protection (interferes with plaques peculiar to Alzheimer's disease), cholesterol balancing, eases joint pain, help with diabetes (reduced fasting blood glucose and increased insulin sensitivity), decreased inflammation, immune system support, longevity (slows aging), lower blood pressure, maintain healthy platelet function, reduced joint pain, may change gene expression, may suppress certain kinds of cancer cells, reduce risk of heart disease and increased blood thinning.

Food Sources: Red wine, red grape skins, purple grape juice, cranberries, jackfruit skin, blueberries, bilberries, lingonberries, mulberries, strawberries, peanuts, pistachios, raw cacao, red currants

Herbal Sources: Japanese Knotweed (*Polygonum cuspidatum*), eucalyptus, spruce (*Picea excelsa*), Bidi Leaf Tree (*Bauhinia racemose*), and Hu zhang (*Polygonum cuspidatum*).

Contraindications: Not recommended for pregnant or lactating women or for children. Possibly overstimulating. Not advisable to take with blood-thinning medications or with certain blood pressure, anxiety or immunosuppressant medications.

Antioxidant Vitamins & Minerals:

Vitamin A (Beta-Carotene), Vitamin C, Vitamin E, and the minerals Selenium, Zinc, Manganese, Copper, and Iron.

APITHERAPY

Apis Mellifica

Homeopathic Apis Mel is prepared from the honey bee and suitable for occasions when the remedy matches the symptoms. "Apis has the ability to treat conditions such as allergies, angioneurotic oedema, arthritis, ascites, asthma, cystitis, dysmenorrhoea, endometriosis, erysipelas and cellulitis, glomerulonephritis, headache and migraine, infertility, influenza, meningitis, nephrotic syndrome, pharyngitis, pneumonia, pyelonephritis, scarlet fever, shingles, and urticarial (hives)."[90]

Bee Pollen Granules

"Pollen is a good source of enzymes and co-enzymes [over 5,000 different types of live enzymes have been identified] and also has the highest anti-oxidant activity, as measured by the ORAC index, of any fruit or vegetable. Because of its nutrient density, one to two teaspoons of pollen is equivalent to a serving of vegetables. Therefore, supplementing your diet with bee pollen is a great way to significantly improve your nutrient intake."[91] However, honeybee pollen does not contain the correct proportion of nutrients required by humans to use as a sole food source for an extended period of time. Thus, while it is beneficial as a supplement, it remains only the "perfect food" for bees!

"Honeybee pollen is the richest source of vitamins found in nature in a single food. Even if bee pollen had none of its other vital ingredients, its content of rutin alone would justify taking at least a teaspoon daily, if for no other reason than strengthening the capillaries. Pollen is extremely rich in rutin and may have the highest content of any source, plus it provides a high content of the nucleics RNA (ribonucleic acid] and DNA [deoxyribonucleic acid."[92]

~ Rutin

Rutin is a powerful anti-inflammatory and antioxidant bioflavonoid that helps the body produce collagen and utilize Vitamin C. The anti-inflammatory/antioxidant combination minimizes cellular damage and inflammation caused by excess free radicals.

If you are interested in bee pollen, follow this link -> **Products from the Hive–Part II: POLLEN**

Pollen is anti-inflammatory, anti-cancer, and anti-arthritic. Its phytochemicals are balancing to the immune system, often used to decrease symptoms in those that suffer from hay fever and sensitivities to windborne pollen.

Pollen has been reported to be useful in many other medical conditions including: varicose veins, high cholesterol and triglycerides, fatigue, infertility, impotence, anorexia, obesity,

constipation, diarrhea, hypertension, prostatitis, depression, scar formation, and recovery from illness and surgery. Pollen is compatible with other therapies, it can be used long term, has no toxicity even at high doses for those who are not sensitive or allergic, and is safe to take as a supplement during pregnancy."[93] In fact, another significant use of pollen is for its curative activity in prostate disorders.

"Pollen also has a multitude of other effects, including strengthening the body against viral infections, relieving fatigue, assisting in the treatment of asthma, improving concentration, and skin problems. It can also help women with painful menstrual cramps or menopausal women with hot flashes. It can relieve headaches and heart palpitations. As well, pollen can increase sexual potency, fertility, and especially benefits the prostate. Regulation of colon problems is another one of its uses, as is a diuretic action of the kidney and bladder. There is even anecdotal evidence of pollen's effectiveness for children with attention deficit disorder (ADD)."[94]

Beebread

Beebread is lacto-fermented honey bee food made from honey or nectar and pollen mixed with enzymes and lactic acid bacteria which live in their honey stomach and are applied through the bees "saliva." These enzymes prevent the pollen from germinating. The raw beebread is tightly packed into honeycomb cells and capped off by worker bees. Then it is allowed to ferment. This fermenting process is what takes a "superfood" like plain ol' pollen granules and transforms it into a substance commonly known as "ambrosia" or "the food of the gods" thousands of years ago.

Interesting things happen as a result of the honey/pollen lacto-fermentation. Fresh pollen, which has a limited shelf life before it goes rancid or molds, is transformed into a product that has an indefinite shelf life like that of honey. The end product is rendered significantly more digestible and even though the protein content is lower than pollen, the bioavailability of the protein is dramatically increased to 63 percent.[95] The fermentation process predigests the proteins into amino acids which are then found to be higher than that of pollen. The acidity of beebread is also high, which helps it to be easily absorbed. Another thing that happens is now, *voilà*, Vitamin K is present where it did not exist previously in either the honey or pollen products. Fermentation seems to "unlock" the minerals bound tightly within the cellulose covering of the pollen seeds in the granules.[96] The end result is a food three times higher in its nutritional and antimicrobial content which is also a good source of unsaturated fatty acids. "Beebread has a large variety of minerals and has high quantities of iron, cobalt, phosphorus, and calcium. It is one of the richest natural foods containing selenium. Beebread is also an excellent source of potassium and B-group vitamins."[97] For those with allergies to bee pollen it would be good to note that allergies to fermented beebread are extremely rare.[98]

Intrigued about bee bread? Click here! -> **Products from the Hive–Part III: BEEBREAD**

Bee Venom (BVT)

Honey bee venom? Yes, it's a thing! …and yes, it hurts! Intentional honey bee stings for medicinal purposes have been around as long as there have been honeybees and people. While there are other types of venom, only honeybees are selected for Bee Venom Therapy (BVT) as their venom is acidic and has many components that can stimulate the body to heal.

There are over 40 compounds that have been identified in bee venom with at least 18 of them having active healing properties. One outstanding chemical that makes up a majority of the venom in a sting is melittin. Melittin is a strong anti-inflammatory chemical (100 percent stronger than cortisone) that causes the release of cortisol in the body. It is also antiviral, antibacterial, and in some cases anticancer.

Science has found a unique ability of bee venom to make holes in the exterior membrane of *Borrelia burgdorferi*, or to destroy the HIV virus, certain cancers, etc. "People are interested in using these peptides to fight cancer and other diseases, in part because organisms cannot change the makeup of their membrane, so it would be very difficult for them to develop resistance to such drugs."[99] BVT has also been found useful in reducing symptoms of chronic illness such as arthritis, lupus, encephalomyelitis, multiple sclerosis, fibromyalgia, and other autoimmune diseases.

Traditionally, live bees are used to sting in one or a combination of three areas: the problem area (i.e. rheumatic joint, broken bone, etc.), trigger points, and acupuncture points. Injectable venom has been standardized for use in modern medicine. "The venom solution is prepared from pure bee venom (Apis Venenum Purum), and to make the solution more harmonized, a homeopathic apis is added to the preparation. It is administered intradermally just between the skin layers or subcutaneously under the skin to imitate the effect of a bee sting. Each injection is equivalent to or is less than the average dry venom sac content of a honey bee,"[100]

"In many Asian countries and Eastern Europe, bee venom has been used as an official medical treatment for some time, according to a UN Food and Agriculture Organization bulletin. 'In the Republic of China, bee venom therapy is combined with a knowledge of acupuncture by many hospitals and physicians,' the bulletin states."[101]

When the body is chronically dehydrated, or lacking the necessary nutritional resources, histamine may be released in response to the venom 'toxin'. In fact, the body of a previously non-allergic person can make the antibody responsible for allergies and suddenly become 'sensitized' to bee stings. This can cause anything from an itchy throat to flushing, hives, beyond-normal swelling, and anaphylaxis.

Bee venom also destroys bacteria. Those with a high bacterial load may experience a "herxheimer reaction", intense flu-like symptoms so severe they are left bed-ridden while the body attempts to clear out the wastes.

Propolis

Propolis, it is an amazing immune-booster and cold and flu remedy. It helps calm the histamine release associated with seasonal allergies, assists with various dental problems, systemic inflammation, and anywhere antioxidants are needed.

"Hippocrates noted that propolis is beneficial for promoting wound healing, both internal and external, while Pliny the Elder documented that propolis may be used to treat tumors, muscle pain and ulcers. This bee product was also documented in the Persian manuscripts as a remedy for various conditions, including eczema and rheumatism."[102]

Click the link for more information about propolis -> **Products from the Hive–Part IV: PROPOLIS**

Royal Jelly

Royal jelly is the honeybee food made by nurse bees to feed to the developing queen bee who stands head-and-shoulders above all the rest! The queen lays from 1,500 to 2,000+ eggs every day. That takes some energy! …and that energy comes from royal jelly.

As a supplement, Royal Jelly "contains all of the B-complex vitamins, including a high concentration of pantothenic acid (vitamin B5), and vitamin B6 (pyridoxine), and is the only natural source of pure acetylcholine. Royal jelly also contains minerals, enzymes, hormones, eighteen amino acids, antibacterial and antibiotic components, and vitamins A, C, D, and E. It is useful for bronchial asthma, liver disease, bone fractures, and skin disorders and it strengthens the immune system."[103]

Royal jelly gives an uplifting type of energy enhancement. It has been utilized in weight loss, fatigue, insomnia, digestive disorders, ulcers and cardiovascular conditions. It is important to preserve royal jelly by combining it with honey as it spoils easily. Keep refrigerated.

ENZYMES

CO-ENZYMES

"A coenzyme is a substance that enhances or is necessary for the action of all enzymes in the body. Coenzymes are generally much smaller molecules than enzymes themselves. Enzymes are large biological molecules that catalyze biological processes and create products in our bodies that we need for basic survival. Without a coenzyme, the majority of enzymes in the body are useless. Enzymes can be compared to production machinery in a factory that transforms one material into another one. In living cells, enzymes catalyze the breakdown and turnover of food components into smaller units, converting food into energy and water. Enzymes can perform their work only if an additional essential factor combines with the molecule itself. This factor is called a coenzyme. Without a complementary coenzyme, enzymes will not work and, therefore, they cannot produce complete protein systems for the human body. Hence, a coenzyme is essential for an enzyme to become active."[103]

Nicotinamide Adenine Dinucleotide (NADH) or NAD

NADH is the reduced but active form of NAD (Nicotinamide Adenine Dinucleotide) that can donate electrons. It is an important co-enzyme (a molecule derived from Vitamin B-3, niacin) in the human body that plays a critical role in the electron transport system. NADH works to transfer energy from food into a form the body can use.

As a supplement, NADH increases the electrical activity of the brain used for attention and decision-making, memory, concentration and focus, by causing the cells of the brain to manufacture ATP (cellular energy). Additionally, NADH increases the chemicals dopamine and norepinephrine as well as serotonin which are neurotransmitters used for brain processing. NADH can participate in the restoration of mitochondrial function and blood vessels, boost muscle function and work to repair damaged DNA and cells.

The level of NAD decreases in tissues with age. In fact, low levels of NAD speed the process of aging. Supplemental NADH can be beneficial for conditions such as Alzheimer's, Parkinson's, and other neurodegenerative diseases. It is also beneficial in lessening jet lag and anxiety, as well as regenerating stem cells within the brain and decreasing the symptoms of Chronic Fatigue.

Food sources: "You get small amounts of NADH by eating meat, poultry and fish. Vegetables have very low concentrations of NADH. So vegetarians are typically low in NADH. And since NADH is very unstable, much of it is lost through cooking."[104]

Contraindications: Not recommended for pregnant or lactating women. "There are no known safety concerns associated with NADH supplement treatment at 5 mg daily or less, according to Winchester Hospital. But the long-term safety of this supplement has yet to be fully evaluated in humans."[105]

ENZYMES

"An enzyme is a substance – usually a protein – created by a living organism that acts as a catalyst to bring about life-sustaining biochemical reactions. …Enzymes typically react with

just one substrate – that is, one specific molecule type. There can be thousands of enzymes at work in one organism, each one with a vital role."[106] Scientific thought estimates there are approximately 3,000 types of enzymes within the human body. All of the metabolic functions that keep our bodies "running" require many different types of enzymes and enzyme complexes to unlock these processes.

There are three basic groups of enzymes. Metabolic enzymes are required for the "running" of our bodies, digestive enzymes break down food into manageable bits for the body to absorb, and food enzymes, available in raw foods, start the digestive process.

Digestive and systemic enzymes occur naturally in raw foods. The body produces some as well. Enzymes in food sources vary and as the body ages its production naturally declines. This increases the need for supplementation. Additionally, packaged food along with any other heavily processed food is devoid of enzymes, forcing the body to take upon itself the entire burden of digestion, a feat it was never designed to do. Heating food over 116 degrees inactivates most of the enzymes. It is important to add both raw and fermented foods to one's diet each day.

Enzymes increase the acidity of the stomach which is beneficial in breaking down foods and protecting the body from parasites. Symptoms of inadequate amounts of digestive enzymes are bloating, indigestion, lethargy, gas, abdominal discomfort, and undigested food in the stool. These symptoms suggest that there may be food rotting in the intestines in turn causing toxins from digestive waste to enter the bloodstream and lymphatic system subsequently decreasing overall immunity.

Think of it this way: whenever the pancreas is not functioning optimally (goes on strike), the immune system will respond to the increase in toxins (because food is not broken down and absorbed properly) and attempt to "take out the garbage." As it is not designed to function under such a heavy workload, the lymphatic system gets bogged down and the body's resistance to infection decreases.

Many enzymes require the presence of "coenzymes" or "cofactors" to catalyze complex molecules. These coenzymes are commonly known as vitamins and minerals. As such, it would make sense that a vitamin and/or mineral deficiency could hinder the effectivity of certain enzymes, ultimately causing "dis"-ease. It is worth noting that "individuals with significant health problems have been shown to have lower levels of enzymes than healthy individuals and that oral enzyme supplementation has been helpful for many such people."[107]

DIGESTIVE ENZYMES - 'HYDROLITIC'

"Bad digestion is at the root of all evil."
~ Hippocrates

Hydrolitic digestive enzymes are proteins that increase the breakdown of larger molecules such as fats, proteins, and carbs which aid in the digestion of food that takes place in the small intestine. They work to balance the gut microbiome, alleviate digestive intolerances and

disorders, and support the pancreas (so that it doesn't have to work as hard to produce digestive enzymes.) Digestive enzymes are plentiful in raw foods but are destroyed by cooking.

"Any enzyme deficiency leading to substrate decrease is similar to a dietary deficiency. Many experimental studies have shown that in pancreatic deficiency the adaptive potency of the organism is responsible for establishing digestive compensation."[108] Substrate refers to the molecule that enzymes act upon. The enzyme converts the substrate into molecules known as the product. Therefore, the "adaptive potency" is the ability of the pancreas to adapt to food intake (i.e. increase certain enzymes when the amounts of food vary. - More carbs, more protein, etc.)

Digestive enzymes that originate in the pancreas are called pancreatic enzymes and they include amylase, cellulase, lipase, and protease. Deficiency of pancreatic enzymes can exacerbate malabsorption as well as the overgrowth of bacteria in the small intestine (SIBO). Symptoms of which often appear as large amounts of gas, bloating, constipation, cramping after eating, fatigue, foul gas/stools, greasy or floating stools, frequent stools, indigestion, light-colored (yellow or orange), loose stools, and weight loss. Symptoms of IBS may also be resolved using Pancreatic Enzymes.

When dietary restriction is not too severe, the biosynthesis of all the enzymes decrease. In this instance the digestive secretions become a nitrogenous material with the purpose of compensating for the essential components lacking in the diet. The body is always attempting to find balance.

The purpose of supplementing digestive enzymes is to correct an imbalance. While this imbalance is in the process of being corrected it is good to use digestive enzymes to offer symptomatic relief. Always take digestive enzymes with food as they need to be able to break down food and will not work on an empty stomach. Digestive enzymes should never be considered a replacement for a healthy diet that includes lots of fresh, raw vegetables, and adequate hydration.

Food sources of digestive enzymes: pineapple, papaya, mango, honey, bananas, avocados, kefir, sauerkraut, kimchi, miso, kiwi, ginger, etc.

Amylase

The enzyme amylase digests the complex sugars found in starches such as legumes and vegetables. It is first found in saliva where it starts the chemical process of digestion in the mouth. It is important to chew food and saturate it with saliva before swallowing as amylase begins digestion. Amylase is also secreted by the pancreas into the duodenum (the beginning of the small intestine) where it is used to further break up carbohydrates.

Cellulase

Cellulase is a digestive enzyme that helps the body break down fiber which is called 'cellulose'. Cellulose is a complex carbohydrate making up the outer cellular structure of green plants and

vegetables. The part of the plant that remains after being broken down by cellulase becomes bulk that is helpful to form stool and expel waste.[109]

Lactase

The 'lac' in lactase comes from the word for milk and the suffix 'ase' from the word for enzyme. Similarly, lactose identifies milk sugars with the 'ose' ending. Accordingly, lactase enzymes digest lactose sugars that make up between two to eight percent of milk. Therefore, Lactase enzymes are dairy-specific and are not designed to work if taken apart from milk products. While most humans are born with the ability to produce sufficient lactase at birth, the amount of lactase production sometimes diminishes in childhood, and sometimes in adulthood. This means that without sufficient quantities of the enzyme lactase, milk products will be incompletely digested and proceed to ferment in the bowel which causes bloating, constipation, cramping, diarrhea, and flatulence.

Some people are genetically lactose intolerant. It is also possible that a viral or bacterial infection can damage the small intestine's ability to produce lactase. Lactose intolerance is "more common in people with Asian, African or Native American heritage and less common in people with a northern or western European background."[110] "About 80 to 90 percent of African-Americans have lactose intolerance, and it is also very common in Asians and Native Americans… It is also important to remember that lactose intolerance increases with age and is quite common in the elderly."[111]

~ Milk Allergies

Lactose intolerance is common throughout the world affecting up to 70 percent of people, yet, lactose intolerance is not a 'milk allergy'. Milk allergy occurs when the person has an autoimmune reaction to the protein (generally casein) in milk. These proteins are found in both raw and pasteurized milk. While raw milk has many health benefits, the bodies of those with milk allergies simply cannot tolerate it.

There is casein in goat and sheep milk as well, but nowhere near as much as in cow's milk. Unfortunately, they do contain a different allergenic protein called beta lactoglobulin at similar levels to cows' milk. Because of this, some may use milk from other animal sources, while others cannot.

Dairy allergy is one of the most common allergies, and is especially high in children. Symptoms include: abdominal distention[112], bloody/mucous stools[112], diarrhea[112], edema[112], failure to thrive[112], gastroesophageal reflux[113], hypoalbuminemia[112], low-grade fever[112], mild to severe rashes, mucus production[114], nausea, regurgitation/vomiting[112], stomach pain, trouble breathing, loss of consciousness, and swelling of the lips or throat.

continued…

Milk Allergies continued.

The association between milk and mucus cannot be explained using the conventional paradigm for diagnosing allergies, however, there is medical evidence that shows cause. As the casein protein breaks down in the colon, casomorphin (an opioid protein fragment) is produced. This stimulates the opioid receptors within colon and triggers the opioid receptors in the respiratory tract to respond to this trigger by secreting mucus. "This association may not necessarily be simply cause and effect as the person has to be consuming A1 milk, β-CM-7 [*casomorphin*] must pass into the systemic circulation and the tissues have to be actively inflamed. These prerequisites could explain why only a subgroup of the population, who have increased respiratory tract mucus production, find that many of their symptoms, including asthma, improve on a dairy elimination diet."[114] [*my clarification*]

Based upon the previous study it is interesting to note that in a subsequent study, cows' milk has been also found to cause inflammation in the intestines that cause failure to thrive in children with cystic fibrosis.[115]

"A variety of disorders, including autism, schizophrenia, and postpartum psychosis, were thought to be due to an inability to process gluten and casein adequately. These products of inadequate digestion, 'gliadorphin' and '**casomorphin**', can be measured in the urine and cerebrospinal fluid of autistic patients. They theoretically **cross both the gut and brain barriers, and then bind with endogenous opioid receptors, causing 'interference of signal transmission**'. It has been proposed that 'gliadorphin' and 'casomorphin' have negative pharmacological effects on attention, learning, social interactions, and brain maturation."[116] [my emphasis]

Lipase

'Lip' in lipase is derived from the word lipo for 'fat'. Lipase helps the body break down fats to make them more easily absorbed. By breaking down fats into triglycerides, lipase plays a significant role in energizing the body. Lipase is helpful with major health challenges such as IBS, celiac disease, cystic fibrosis, gallbladder insufficiency or lack of gallbladder, waning nutrient absorption, and weight loss. It is frequently taken in combination with protease and amylase.

Fluoride appears to have an inhibiting effect on both lipase and protease enzymes. "This study revealed that excessive fluoride inhibits the activities of pancreatic lipase and protease and causes observable ultrastructural changes. These effects might be an important reason for growth depression induced by fluorosis. Excessive production of free radicals induced by fluoride may damage the structures of digestive enzymes and reduce their activities."[117]

Elevated lipase levels may be attributed to bowel obstruction, celiac disease, duodenal ulcer, infection or inflammation of the pancreas, or pancreatic cancer. It is also possible to have high lipase markers when there is no problem with the pancreas.

Food sources of lipase: barley, chickpeas, coconut, eggplant, lupini beans, lentils, mung beans, nuts and seeds, oats, sprouts, walnuts, pine nuts.

Protease

"Dietary protein from the hamburgers, poultry, steak, fish and beans that you eat is made up of large macromolecules that can only be absorbed after digestion into individual amino acids. While the stomach produces pepsin, an enzyme that starts the process of breaking down dietary protein, the pancreas produces trypsin and chymotrypsin, two protease enzymes that digest most of the dietary protein while inside the small intestine. Because these potent enzymes have the ability of digesting the pancreas itself, they are secreted and delivered to the small intestine in their inactive forms, trypsinogen and chymotrypsinogen."[118]

SYSTEMIC ENZYMES - 'PROTEOLYTIC'

Proteolytic enzymes are used to reduce inflammation. Around age 27 systemic enzyme production begins to drop off and by 40 years old the drop is dramatic. Supplementing systemic enzymes as we have need is helpful for reducing pain and inflammation. Some people take enzymes for pain instead of NSAIDS because their anti-inflammatory capacity is so great.

Generally, systemic enzymes work to reduce swelling thereby providing analgesic effects. "Systemic enzymes are natural, anti-inflammatory agents. They digest scar tissue and often even fibroid tumors. They help modulate the immune system. They cleanse the blood by digesting debris that should not be in healthy blood, and they also fight viruses (most likely by breaking down the virus wall to allow the immune system to identify and fight the virus)."[119]

They are also helpful for reducing conditions consisting of fibrin such as the buildup of scar tissue which often occur because the person body does not produce enough of the enzymes it needs during the recovery from surgery or trauma. Other conditions related to fibrin deposition are fibromyalgia and atherosclerosis. Proteolytic enzymes also work to clear cellular waste and toxins out of the blood which supports healthy liver function and is important for longevity, as well as reducing the risk of heart disease and stroke.

Vitamins and minerals are co-enzymes necessary for proper enzyme activation. For instance, magnesium is known to "activate" 2,600 enzymatic reactions and zinc activates 600. Enzymes are safe for animals as well.

Systemic enzymes should always be taken on an empty stomach, 2-1/2 hours after eating and no less than 40 minutes prior to eating. If systemic enzymes are taken with food, they will be used digestively and the system effect that is desired will be lessened or may not occur.

Bromelain

Bromelain are proteolytic enzymes derived from pineapple fruit and/or the stem. It is extensively used to reduce inflammation and swelling, boost immunity, and increase circulation. It can be useful for sinus

infection and inflammation, bronchitis, allergies, and other problems within the nasal passages. It can be used to encourage the healing of sprains and strains, tendonitis, bruises, and soft-tissue injuries. Bromelain may also be considered to alleviate inflammatory symptoms of rheumatism and osteoarthritis, as well as autoimmune diseases, asthma, and diarrhea.

Like papain, bromelain may be used for bloating, indigestion and heartburn, as well as topically for the bites and stings of insects.

Research suggests that bromelain may have anti-tumor properties and may increase the effectiveness of certain chemotherapy drugs. One study showed bromelain had "cytotoxic effects" in human gastric and colon cancer cells as well as having an ability to impair the survival of cancer cells.[120]

Contraindications: Women should not use during pre-conception, or if pregnant or lactating. Do not use if on blood thinning medications. Bromelain may increase the amount of certain drugs in the body such as antibiotics, and anticoagulant or antiplatelet drugs. Due to its blood thinning effects, be sure to discontinue use two weeks prior to any scheduled surgery.

Nattokinase

Nattokinase is a fibrinolytic enzyme derived from Natto that "breaks down cross-linked fibrin proteins that stick to the walls of blood vessels and contribute to the formation of blood clots and atherosclerotic plaques. It also enhances the body's production of plasmin and other clot dissolving agents."[121]

Natto is a fermented cheese-like substance derived from soybean by the Japanese for thousands of years. It acts as a blood cleanser by breaking down fibrinogen, the fibrous agent found in scar tissue, blood clots, atherosclerotic plague, and nasal polyps. It reduces LDL cholesterol and increases HDL cholesterol. "Nattokinase has strong fibrinolytic activity and may be useful for improving circulation and reducing the risk of thrombosis."[122]

Therefore, Nattokinase may be useful in increasing circulation, lowering blood pressure, dissolving blood clots, deep vein thrombosis, and heart disease prevention. It is a better blood thinner than aspirin (whose side effects include triggering bleeding and gastric ulcers.) An Egyptian study indicated that Nattokinase could be beneficial for those with Alzheimer's. It is worth considering for conditions such as chronic obstructive pulmonary disease (COPD), bronchitis, and sinusitis.[123]

The typical dosage for Nattokinase is 100 mg (2,000 FU) once or twice daily.[123] Be sure to avoid products made from genetically engineered soy.

Contraindications: Nattokinase is not recommended for those with coagulation disorders, or those who are receiving antiplatelet therapy (Plavix or Ticlid), or anticoagulation therapy (Coumadin), or for those with hypotension, and/or hyperkalemia. Nattokinase will thin blood. Advise clients who are taking blood thinners to speak with their physicians regarding their desire to use this supplement.

Pancreatic Enzymes (Systemic)

Pancreatic enzymes work digestively when taken with food. They are also known to work systemically when ingested apart from food. "Interestingly, pancreatic enzymes may also be very useful in the treatment of cancer. When used for this purpose, pancreatic enzymes are taken between meals rather than with them. When taken at a time when they're not needed for digestion, the enzymes have been shown to go to work systemically, affecting your body organs via your blood." [124]

Pancreatic enzymes are useful for food allergies, weight loss, impaired digestion, pancreatic insufficiency, Celiac Disease, inflammation, cystic fibrosis, sports injuries and trauma, viral infections (Shingles, AIDS), various cancers, and autoimmune disorders such as Crohn's, Rheumatoid Arthritis, Lupus, Scleroderma, and Multiple Sclerosis.

Dose: Full-strength dosing is preferred at 10x USP with 500 to 1,000 mg three times per day 10-20 minutes before meals when utilized for digestion. For digestion-related benefits, non-enteric-coated pancreatic enzymes have been found to exceed the benefits of those that are enteric-coated. To reduce inflammation, take on an empty stomach.

Papain (Papaya proteinase I)

Papain enzymes are found in the fruit, leaves, seeds, and roots of the papaya plant. They are soothing to the stomach, boost protein digestion, and are known to stimulate digestion. Used primarily as an anti-inflammatory and for its anticancer effects, papain is also an aid for low stomach (hydrochloric) acid, bloating, constipation, provides immune system support, decreases muscle pain in athletes, reduces pain in herpes zoster and shingles, as well as having the ability to digest (thin) mucus. It is also anti-inflammatory and has been found helpful for prostatitis.

Topically, papain does not harm healthy skin, however, it is beneficial for boosting the healing of wounds, burns, rashes, bedsores, skin ulcers, insect bites and stings, sore throat pain, and sports injuries. Additionally, papain has also been found to have antioxidant properties as strong as the vitamins C and E.

Contraindications: Women should not use during pre-conception, or if pregnant or lactating. Do not use if on blood thinning medications. Children with cystic fibrosis should avoid papaya fruit (and should not take enzymes.) Papain enzymes may lower blood pressure, therefore, those with hypoglycemia, diabetes, hypotension, and those on hypotensive drugs must use with caution. Consuming excessive amounts of papain enzyme may lead to stomach discomfort, gastritis, and throat irritation. Check for skin sensitivity before applying to a large area topically. Due to its blood thinning effects, be sure to discontinue use two weeks prior to any scheduled surgery and be aware it has potential to increase menstrual bleeding. For short-term use only.

Serrapeptase

Serrapeptase is considered the strongest fibrinolytic enzyme. It is an anti-inflammatory enzyme from newborn silkworms that helps them dissolve their cocoons. It is cultured and fermented, therefore, Serrapeptase is suitable for vegetarians.

In humans, Serrapeptase can help with the absorption of amino acids and protein metabolism. Serrapeptase has been found to benefit inflammatory conditions such as fibromyalgia and carpal tunnel syndrome, and to reduce Alzheimer's-related toxins, arterial plaque, blood clots, breast engorgement, bronchitis, trauma, and surgery-related swelling. Additionally, it has been found to be helpful in breaking down Lyme disease-associated biofilms.[125]

Serrapeptase actually works best in conjunction with other synergistic enzymes such as bromelain, amylase, rutin, papain, etc.

Contraindications: Serrapeptase has not been proven safe for pregnant or breastfeeding women. Rare but possible side effects include Stevens-Johnson syndrome, problems with blood coagulation, dermatosis or Erythema, joint pain, or muscle ache.

ESSENTIAL FATTY ACIDS

Essential fatty acids (EFAs) are a good thing! Without them, there is no life as they are foundational building blocks to cellular structure. Many of the fatty acids the body requires can be made from other fats, except for two. These two are considered essential because they must be taken in through the diet. The first is linoleic acid (an omega-6 fatty acid) and the second is alpha linolenic acid which is an omega-3 fatty acid.

Men require 17 grams of omega-6, and 1.3 grams of omega-3 fatty acids each day.
Women need 12 grams of omega-6 and 1.1 grams of omega-3 fatty acids each day.

Signs of Essential Fatty Acid Deficiency

- Allergies
- Anxiety
- Arthritis
- Attention Difficulties – especially w/ADD, ADHD, & Autism Spectrum Disorders
- Cognitive Decline
- Depression
- Digestive Malfunction
- Emotional – Mood Swings
- Eyes – Dry eyes, poor night vision, bright light sensitivity, reading disturbances
- Fatigue
- Feminine Issues – Menstrual Irregularities, inadequate vaginal lubrication, tender or painful breasts before menstruation, menstrual cramps
- Heart Disease (or risk of)
- Inflammation
- Joint Pain
- Muscle Pain
- Mental Disorders
- Skin, Hair, & Nail Problems
- Sleep – Difficulty falling asleep
- Waking – Difficulty waking up

Food sources of Omega 3: Mackerel, salmon, cod liver oil, rainbow trout, herring, oysters, sardines, anchovies, caviar, flax seeds/oil, chia seeds, English walnuts, pastured eggs, grass-fed meat, hemp seeds, spinach, Brussels sprouts, and purslane.

Food sources of Omega 6: Safflower, sesame oil, sunflower seeds and oil, pine nuts, pecans, poppyseed oil, walnut oil, grapeseed oil, and Brazil nuts.

OMEGA-3s 'essential' (EPA / DHA / ALA)

Omega-3s nourish the nervous system and make up a part of the actual membranes of the nerve cell. It is an important fat for the brain and low levels can hinder the ability to learn. Omega 3s are important to heart health and circulation as they reduce inflammation and regulate cholesterol and blood pressure.

There are two primary types of omega-3s. The long-chain omega-3 fatty acids are EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid). Both of these are abundant in fish and shellfish. One plant source of DHA is found in algae but it does not provide EPA. Another omega-3 is ALA (alpha-linolenic acid) a short-chain fatty acid found in plants such as flaxseed. The body must convert ALA to EPA and DHA for it to be of use.

EPA is a different structure than DHA, however, to get the full effect of Omega-3 fatty acids the body requires both! EPA is the regulator of hormones that control pain and inflammation and is beneficial for improving joint conditions caused by injury or aging reducing the risk of dementia and Alzheimer's disease.

DHA is the building block of the tissues in the brain. The brain is made up of 60 percent DHA fat, so it becomes easy to understand how deficiency would have a negative effect on cognition and mental health. It also plays a part in increasing the flow of blood to the brain during mental tasks as well as creating neural transmitters that are significant for the proper functioning of the brain.

Also significant is the role DHA plays in the health of the retina and eye health in general. It has been found that DHA improved dry eyes "…500 mg of DHA and 1,000 mg of EPA daily for three months decreased eye pressure in healthy people by 8%. Elevated eye pressure is a risk factor for glaucoma, a disease that gradually erodes vision."[126]

A two-study analysis found that "women consuming 600–800 mg of DHA daily during pregnancy reduced their risk of early preterm birth by more than 40% in the US and 64% in Australia, compared to those taking a placebo."[126]

OMEGA-6s 'essential'

Omega-6s help to reduce chronic inflammation and symptoms of rheumatoid arthritis such as swelling, stiffness, and joint pain. ADHD symptoms may be lessened by incorporating both omega-6 and omega 3s into a daily routine.

Contraindications – Omega-6s: Both borage oil and evening primrose oil lower the seizure threshold, therefore, those taking anticonvulsant medications should exercise caution with these two oils.

OMEGA-9s 'non-essential'

Omega 9s are the body's most common fat. The body makes its own omega-9 fatty acids from Omega-3 and Omega-6 fatty acids; therefore Omega-9 is not considered essential. However, if there is not enough of both Omega-3s and Omega 6s provided in the correct balance, the body will not have the resources to produce Omega 9s.

Omega-9s or 'oleic acid' are known to boost energy and enhance mood while lessening anger. They also can be beneficial for those with Alzheimer's disease. Omega 9s are known to help allergies, anxiety, asthma, arthritis, diabetes, high blood pressure, muscular disorders, skin disorders, and stress.

A tablespoon or two of extra virgin olive oil is a sufficient daily dose of Omega 9s.

Signs of Omega-9 Deficiency[127]

- Dandruff
- Dry Eyes
- Dry Glands
- Dry Hair
- Eczema-type Skin Eruptions
- Growth Retardation
- Male Sterility
- Miscarriage
- Stiff and/or Painful Joints
- Urge to eat Fatty Foods

Food sources of Omega 9s: Almond butter, avocado oil, cashews, fish, chia seed oil, grains, green leafy vegetables, hazelnut, macadamias, olive oil, peanut oil, pistachios, pumpkin seeds, safflower oil, sesame oil, sunflower seeds, walnuts.

Contraindications – Omega-9s: None.

FATS & OILS

"Fats from animal and vegetable sources provide a concentrated source of energy in the diet; they also provide the building blocks for cell membranes and a variety of hormones and hormone-like substances. Fats as part of a meal slow down nutrient absorption so that we can go longer without feeling hungry. In addition, they act as carriers for important fat-soluble vitamins A, D, E and K. Dietary fats are needed for the conversion of carotene to vitamin A, for mineral absorption and for a host of other processes."[128]

Algal Oil (Omega 3 EPA/DHA)

Algal is a plant-based oil made from algae that contains the omega-3 fatty acids EPA and DHA in a very bioavailable triglyceride form. However, unlike fish oil, algal generally does not contain much of the Omega-7s which are helpful in improving cholesterol and reducing inflammation.

Black Cumin Seed & Oil

"There is healing in Black Seed for all diseases, except death."
(Sahih Bukhari 7:71:592)

Black seed (*Nigella sativa*) is a virtual medicine chest containing both Omega-3 and Omega-6 fatty acids. It is analgesic, antibacterial, anti-cancer (including brain, breast, colon, and prostate), anticholinergic, anti-diabetic, antifungal, anti-histamine, anti-inflammatory, antimicrobial, anti-mold, antioxidant, anti-ulcer, antiviral, bronchodilator, digestive, emmenagogue, galactagogue, hypotensive, immune-supportive, kidney-protective, laxative, liver-protective, relaxant, and re-sensitizing to insulin.
If nothing else does, the antimicrobial properties of black seed oil should cause us to sit up and take notice. One study tested 144 strains of pathogenic antibiotic-resistant/multi-drug resistant bacteria compared to antibiotics such as Amoxicillin, Ciprofloxacin, Erythromycin, and Tetracycline and found that "97 were inhibited by the oil of black cumin."[129] The potency of this plant against microbes is second only to oregano oil. When it comes to methicillin resistant Staphylococcus aureus (MRSA), scientists in Pakistan found that an ethanolic extract of *N. sativa* had an inhibitory effect on MRSA, verification that Black Seed Oil can reduce or eliminate MRSA. For a "folk medicine" as they call it, this is powerful stuff![130]

…And that's not all. "Explained in a recent article published by the *Journal of Endocrinology and Metabolism*, researchers from the Indian Council of Medical Research highlight that black seed oil 'causes gradual partial regeneration of pancreatic beta-cells, increases the lowered serum insulin concentrations and decreases the elevated serum glucose." This is actually quite profound because *Nigella sativa* is one of the few substances on the planet that is suggested to help prevent both type 1 and type 2 diabetes**.** In fact, according to the study, black seed 'improves glucose tolerance as efficiently as metformin; yet it has not shown significant adverse effects and has very low toxicity."[131]

The results of one study of 35 opioid-dependent persons were treated using 500 mgs of Nigella Sativa. The study found that "non opioid treatment for opioid addiction decreases the withdrawal effects significantly. It further demonstrates that there are no changes in physiological parameters of subjects during treatment (BP, Pulse rate etc.). There is increased appetite but no significant weight gain in the subjects." Therefore, the researchers concluded, the "Non opioid drug Nigella sativa is effective in long-term treatment of opioid dependence. It not merely cures the opioid dependence but also cures the infections and weakness from which majority of addicts suffer."[132]

Conditions that may be benefitted by Black Seed Oil are: allergies, alopecia, Alzheimer's disease, apathy, asthma, autism, cholesterol, imbalances, dementia, Diabetes 1 and II, infertility (male), glaucoma, hypertension, myasthenia gravis, lactation, neurodegenerative conditions, postural tachycardia syndrome, schizophrenia, Parkinson's disease, and weight loss.

Black cumin seed oil should be diluted before topical application and may be helpful for acne, eczema, psoriasis, and rosacea.

When purchasing black cumin seed or oil be sure to select a pure organic, unrefined, and cold-pressed oil.

Contraindications: Side effects may include nausea, vomiting, or constipation, and increased seizure risk for certain individuals. If pregnant or lactating consult your doctor before use. Discontinue use two weeks prior to scheduled surgery.

Castor Oil

Castor oil (*Ricinus communis*) is an Omega-9 fatty acid derived from the castor bean and made up of almost 90 percent fatty acids. Its actions are antibacterial, anti-diabetic, anti-fungal, anti-inflammatory-antimicrobial, antioxidant, hepatoprotective, hormone-balancing, wound-healing, and it is a free-radical scavenger.[133] It supports the lymphatic system by boosting blood circulation, lymphatic drainage, supporting the thymus gland, and regulating the immune responses of the body. Castor oil balances hormones by augmenting the absorption of fat molecules necessary to hormone production. It can also act as a mild laxative.

Used topically, castor oil reduces acne-causing bacteria, nail fungus, and moles and cysts. It has healing properties for sunburned and dry skin, relieves an itchy scalp and promotes hair growth. Another topical type of application for castor oil is the castor oil 'pack'. This is a castor oil saturated cloth with gently warmed castor oil which is applied to the skin above an organ and allowed to penetrate. It is said to "draw" out toxins and relieve pain and inflammation. In one Turkish study of two rest homes, castor oil packs were administered to residents, 80 percent of which had been constipated for 10 years or longer. The results of the study concluded that castor oil packs "may be used for controlling symptoms of constipation."[134]

When selecting castor oil choose only organic, cold-pressed, and hexane-free products.

Coconut Oil

Coconut oil is an Omega-3 oil with antibacterial, antifungal, antimicrobial, antiviral, anti-inflammatory, and analgesic properties. As it reduces inflammation in the body, pain levels decrease.

The saturated fats in coconut oil reduce inflammation, boost immune function, protect the liver, support the cardiovascular system, help cognitive function, as well as increase energy levels. It improves brain function including memory. In the GI tract, coconut oil improves the absorption of fat-soluble vitamins along with calcium and magnesium, therefore increasing bone volume. It lubricates the intestines which is especially helpful for those with Crohn's, constipation, or IBS.

"Monolaurin found in coconut oil also causes the death of bacteria and microorganisms like *Staphylococcus aureus, Candida spp., Helicobacter pylori, Escherichia vulneris* and *Enterobacter spp*. This compound can even dissolve lipids and phospholipids (fats)."[135]

Normalizing weight is coconut oil's forte. It is helpful for fat loss, as well as weight gain, whichever the body needs. It is also used in bodybuilding and for reducing abdominal obesity. It has also been found to lower LDL while raising HDL cholesterols. Replacing the other oils or saturated fats in one's diet with coconut oil or MCT oil creates a higher degree of satiation. It is especially beneficial for people suffering from malnutrition, malabsorption, disorders affecting the metabolism of fatty-acids as well as those who are convalescing or post-operative. Coconut oil also increases the formation of bile acids and when taken in moderation, is beneficial for those whose gallbladders are having difficulty with the breakdown of fats or for those who no longer have a gallbladder.

Coconut oil is helpful for Alzheimer's Disease because the liver's digestion of medium-chain fatty acids (MFCAs) "creates ketones that are readily accessible by the brain for energy. Ketones supply energy to the brain without the need for insulin to process glucose into energy. Recent research has shown that the brain actually creates its own insulin in order to process glucose and power brain cells. As the brain of an Alzheimer's patient loses the ability to create its own insulin, the ketones from coconut oil could create an alternate source of energy to help repair brain function."[136]

For oral health, coconut oil is helpful for dry mouth. Oil "pulling" inhibits sugars that break down in the mouth along with working to eliminate excessive bacteria that can lead to tooth decay.

Coconut oil melts at 76 degrees Fahrenheit. It is suitable for high-temperature cooking (below 450 degrees) and can easily be substituted for butter in baked goods. A daily amount to incorporate into one's diet would fall between one teaspoon and 2 tablespoons for maintenance. To increase one's metabolic rate, take between one and two tablespoons. To avoid digestive distress, start small and gradually increase consumption.

When selecting coconut oil look for a pure, organic, virgin or 'extra' virgin oil that is unrefined, unhydrogenated, and cold pressed. There will likely be small chunks of coconut in the oil, especially at the bottom of the container. This is a clue that it has been minimally processed.

Cod Liver Oil (Omega 3 EPA/DHA)

Cod liver oil is a nutrient-dense source of vitamins, especially vitamin A and vitamin D as well as being high in the pre-made omega-3 fats EPA and DHA. EPA and DHA are significant as they are anti-inflammatory, and provide necessary brain and nervous system support.

Vitamin D and Omega-3s are important for bone and joint growth, cardiovascular, depression, fighting autoimmune diseases, hormonal, enhances immunity, reducing the risk of inflammatory eye diseases such as glaucoma and macular degeneration, reducing menstrual pain and benefitting reproductive health, for neurological health, reducing cancer risk, benefitting rheumatism and aching joints and stiff muscles, skin health, and for proper sleep.

On the other hand, "fish oil is a highly processed waste product of the fishing industry. You may not want to take is after reading how it is manufactured… The omega-3s it contains will likely be highly damaged (that is, rancid) from the high-temperature processing, and fish oil does not supply appreciable amounts of vitamins A and D. …We do need omega-3 fatty acids, but not too much! Best to stick with small amounts of cod liver oil, to ensure adequate intake of vitamins A and D-in the context of a diet containing meat, organ meats, eggs, and animal fats like butter-and avoid the popular fish oils."[137]

Evening Primrose Oil (GLA)

Evening Primrose Oil (EPO) is a natural promoter of estrogen and a rich source (between 7 and 10 percent) of the omega-6 fatty acid GLA. (See Gamma-linolenic acid [GLA] below). It is beneficial for skin conditions like dry or scaly skin, eczema, and psoriasis. It is known to be a helpful remedial due to its high content of fatty acids in alcoholism and diabetes, both being conditions that lean toward a deficiency of GLA. Additionally, evening primrose oil is neuroprotective. Helpful to diabetics and those suffering from neurodegenerative diseases such as multiple sclerosis who deal with pain, tingling, numbness, and other issues in the limbs. "A combination of fish oil, evening primrose oil, and calcium has been shown to improve bone density in seniors."[138]

Heart health is benefitted by evening primrose oil by its effect on lowering cholesterol and blood pressure, and in this manner protecting and reducing the risk of atherosclerosis and heart disease. Females benefit from the hormone-balancing effects of evening primrose by gaining relief from suboptimal uterine function, mastalgia, hot flashes and night sweats, and menstrual problems like PMS, cramps, cyclical breast pain, and heavy bleeding. GLA in evening primrose may benefit male impotence due to inadequate circulation which restricts penile blood flow. "The oil is usually taken together with ginkgo biloba and vitamin C for optimal benefits. Additionally, once the oil is taken over a longer period of time, GLA might help to prevent one's blood vessels from becoming narrow, which is something that is frequently due to a buildup of plaque from high cholesterol."[139]

Contraindications: Those with epilepsy or who are prone to convulsions should not consume evening primrose oil. Long-term supplementation may increase risk of bleeding and if supplemented without balancing doses of omega-3s, an imbalance is likely to occur, often causing the very symptoms one is trying to reverse.

Flax Oil (Omega 3 ALA)

Flaxseed (*Linum usitatissimum*) is known to benefit digestion, skin, and heart health. It is the richest source of vegetable-based Omega-3 oils and also contains healthy amounts of a-linolenic acid (ALA).

The health benefits of flaxseed oil have been found to affect cancer, cardiovascular diseases, cellulite (as it increases collagen production), helps either constipation or diarrhea, digestion, eczema, inflammation, osteoporosis, prostate problems, Sjogren's syndrome, skin/hair/nails, and weight loss.

"With flaxseed oil, the omega-6:omega-3 ratio is 0.3:1, which is exactly in line with how much of each type of fat you should be consuming. Flaxseed oil contains ALA, which the body converts into eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), which are the omega-3 fatty acids readily available in fish oil. It's also naturally high in antioxidants like tocopherols and beta-carotene, but researchers indicate that traditional flaxseed oil may lose these properties when it's extracted and purified."[140]

Flax oil loses some of its punch because the body must work to convert ALA into EPA and DHA. The "ALA content of one tablespoon of flaxseed oil (Flax Original Oil - NZ made) is around 8600 mg. So each tablespoon of flaxseed oil provides:

- 20% conversion of 6000 mg of ALA = 1720 mg EPA
- 4% conversion of 6000 mg of ALA = 344 mg DHA
- Combined, converted EPA/DHA per tablespoon flaxseed oil = 2064mg"[141]

When selecting flaxseed oil as a supplement verify that it is organic, unrefined, pure (others oils can be added to improve stability), and cold pressed. Some manufacturer's use processes that minimize oxidation which is good to consider.

Deterioration, also called 'oxidation' of flaxseed oil is a drawback. The oil quickly becomes rancid when heated, so in food preparation flaxseed oil should only be used raw (salads, etc.)

Contraindication: Do not cook flaxseed or use flaxseed oil as heat rapidly causes rancidity.

Gamma-Linolenic Acid (GLA)

Gamma-linolenic acid (GLA) is a type of omega-6 fatty acid that the body converts into inflammation-reducing substances and those that promote cellular growth. GLA has been found to lessen the nerve pain of diabetic neuropathy, and reduce high blood pressure and the risk of heart disease. It is necessary for proper brain development and is naturally provided by mothers to their infants in breast milk.

Food sources of GLA: Black currant seed oil, borage oil, evening primrose oil, hemp seeds, and spirulina.

Contraindication – Omega-6s - GLA: The effects of certain drugs may increase or decrease with the use of GLA.

MCT Oil (Medium Chain Triglycerides)

Medium chain triglycerides (MCTs) are a source of fast energy that do not require bile salts for digestion. They are easily absorbed by the intestine without requiring pancreatic enzymes, therefore, MCT oil does not burden the pancreas to break them down. After being absorbed through the small intestine, medium-chain fatty acids proceed directly through the cell's mitochondrial membrane to become a source of rapid energy for the body. Carnitine is not necessary for transport as is the case with long-chain fatty acids. This method of digestion precludes coconut oil, a saturated fat, from inclusion in the cholesterol cycle and subsequent fat deposits.[142]

"MCT (Medium Chain Triglyceride) oil may help control weight loss in patients with uncontrolled malabsorption. MCT oil is a calorie-rich type of fat that bypasses usual fat absorption and is rapidly absorbed by the body. It is found naturally in coconut oil, palm kernel oil and butter. MCT oil is added to some medical nutritional supplements and can also be purchased alone as a nutritional supplement. Use of oral nutritional supplements may promote weight gain, help increase strength and physical activity, and improve quality of life."[143]

Olive Oil (Omega-3, Omega-6 & Omega-9)

"Thou lovest righteousness, and hatest wickedness: therefore God, thy God, hath anointed thee with the oil of gladness above thy fellows." Psalm 45:7

Olive oil has been used in food preparation, in lamps as a source of light, for medicinal purposes, and in religious ceremonies from the time there were written records. Hippocrates (the father of modern medicine) highly esteemed olive oil and even listed 60 conditions that were benefitted by it. To this day, science has found extra-virgin olive oil to benefit health in the following ways:

A List of Benefits of Extra-Virgin Olive Oil[144]

Anti-aging

- Maintains cellular integrity and reduction of ageing
- Reduces the incidence of Parkinson's and Alzheimer's disease by 13%

Cancer

- Protects against 10 types of tumors including: colon, stomach, breast, prostate, and lung
- Lowers mortality rate for cancer by 6%
- Has a chemo-protective action

Cardiovascular

- Reduces LDL cholesterol (and corresponding oxidation process) and increases HDL cholesterol
- Benefits atherosclerotic conditions by preventing and reversing damage to vascular endothelium
- Inhibits the formation of blood clots/platelet aggregation
- Vasodilator: Reduces both systolic and diastolic pressure in hypertension
- Lowers mortality for cardiovascular diseases by 9%
- Reduction of risks for patients with cardiac pathologies

Diabetes II

- Reduces macrophage-mediated inflammation (LTB4) and corresponding insulin resistance
- Reduces thromboxane (TXB2) production (which causes platelets to aggregate)
- Improves insulin sensitivity without increasing secretion
- Improves lipid profile and glycemic index
- Reduces production of free radicals and corresponding damage to the cell membrane, mitochondria, and DNA
- Prevents oxidation

Obesity

- Anti-inflammatory
- Increases the sense of satiety

Olive oil is made up of Omega-3, Omega-6 fatty and Omega-9 fatty acids. It is "different than both flaxseed oil and fish oil because it's made up of mostly oleic acid, which is a type of omega-9. Oleic acid is a monounsaturated fat that serves as a major source of energy for our cells."[145]

Additionally, olive oil contains oleocanthal which is found in pure extra virgin olive oil and has painkilling effects. This is evident by that spicy, peppery "bite" one feels in the back of the throat when olive oil is consumed neat. If the oil does not have this effect (as most of the oils found in grocery stores do not) there will be little to no medicinal effect. The typical consumption of olive oil as part of the Mediterranean diet (primarily vegetables, fruits, fish, and nuts) is between 25 and 50 ml. That is approximately two to four tablespoons consumed each day on salads and vegetables as dressings or a drizzle, and in cooked foods.

"A daily dose of 50 g or 4 tablespoons of olive oil confers the equivalent of around 10% of the recommended ibuprofen dose for adult pain relief, says researchers led by Paul Breslin of the Monell Chemical Senses Center in Philadelphia, who discovered the effect. So although it won't cure a headache, it may give you some of the long-term benefits of repeated ibuprofen use, including helping to ward off Alzheimer's."[146]

Red Palm Fruit Oil

Red palm oil is derived from the fruit of the palm. It is a nutritious oil, very high in vitamin E complex that is very beneficial to the brain and the liver. Natural vitamin E complexes in food are called α-tocotrienols. "Current developments in α-tocotrienol research demonstrate neuroprotective properties for the lipid-soluble vitamin in brain tissue [as it] is rich in polyunsaturated fatty acids (PUFAs)."[147]
The vitamin E complex in red palm fruit oil is: anti-cancer, anti-tumor, neuroprotective, protective of the arteries from oxidative damage, a reverser of radiation damage, and beneficial for hair regrowth.

Red palm oil also contains lauric acid (as does coconut oil and breast milk) which the body converts to monolaurin, a very antimicrobial fat that boosts the immune system and decreases the viral load in the body. It is helpful to reduce candida and fungus. Monolaurin is preventative and used in the treatment of the common cold, the flu (influenza), swine flu, herpes, shingles, and other infections.[148]

Red palm oil also has a natural vitamin A precursor (both alpha and beta carotene) that converts into retinol which is the active form of vitamin A. There has been improvement in eyesight correlated with the consumption of red palm oil as blindness can be associated with vitamin A deficiency."[149] Additionally, there are phytosterols which are precursors to steroid hormones such as cortisol, that help the individual in their response to stress.

When purchasing this oil, please verify that it is ecologically and sustainably harvested and be sure to select organic, unrefined, and cold-filtered/pressed.

Wheat Germ Oil / Vitamin "F" (EFAs) / Octacosanol

The “germ” of the wheat comes from the reproductive part of the wheat berry. It is full of nutrients meant to nourish the new plant as it grows. Due to the oils, the germ is removed from processed wheat products because it is not shelf-stable for long periods of time.

Within Wheat Germ Oil there are omega-3 and omega-6 oils and vitamins A, B, E, D, and the mineral magnesium, along with antioxidants that act upon free radicals and increase attention and memory. It is not a balanced ratio of omega 3 to 6 fatty acids, so while beneficial, ingest in moderation.

One teaspoon of wheat germ oil provides 10 IUs of highly bioavailable vitamin E, much more than the commonly available synthetic, isolated forms. “The biologic availability of vitamin E is based on its ability to reverse specific vitamin E-deficiency symptoms; therefore, overall, the synthetic has less ability to correct vitamin E deficiencies than food vitamin E. The body regulates plasma vitamin E through specific liver alpha-tocopherol transfer protein, whereas it has not such protein for other vitamin E forms. Thus, the liver produces a protein to handle vitamin E found in food, but not for the synthetic forms.”[150]

Wheat germ oil as a supplement has been found to benefit those with cardiovascular disease, and those who have had heart attacks and strokes. There is a metabolic effect that is beneficial for weight loss as it encourages passive fat metabolism. It is helpful to keep insulin and glucose levels regulated as it contains magnesium and omega-3 fatty acids which are energy-producing.

Clinical use of wheat germ oil (vitamin E) in 80 women with various reproductive difficulties revealed that “Wheat germ oil (vitamin E) appears to be of definite value and to have its greatest scope of usefulness in the prevention of repeated spontaneous abortions (habitual abortion) for which no cause is obvious.”[151] In a group of 23 women whose lactation was inadequate during the first six weeks from birth, wheat germ oil therapy restored efficient lactation in 35 percent of them.[152]

The high vitamin E content of wheat germ plays a considerable part in the development and function of the reproductive organs as well as the metabolic system of the body. One hundred grams (approximately 4 ounces) of wheat germ contains as much as 30 mgs. of pure bioabsorbable vitamin E. This is helpful to avoid premature birth. Animals with insufficient vitamin E have resorbed their fetuses which has been corrected by wheat germ oil vitamin E supplementation.

The chemical Octacosanol found in wheat germ oil lowers cholesterol levels and increases athletic endurance. The results of one study suggests that “octacosanol may be a beneficial supplement to protect against the poor cholesterol levels and oxidative stress that occurs during taekwondo training.”[153]

It is also believed that Octacosanol acts as a catalyst at the cellular level effecting the transfer of oxygen from the blood into muscle tissue reducing lactic acid build-up and improving physical performance. It is anti-stress in that it boosts glutathione and is a free-radical scavenger. It is

known that “Octacosanol enjoys a good reputation in boosting athletic performance. A study published in the Journal of Medical Food showed that athletes who take Octacosanol supplements had better ability to utilize oxygen as well as prevent muscle breakdown”[154]

Therefore, due to its oxygenating work at the cellular level, Octacosanol can be beneficial for those with cardiovascular diseases, problems concerning their eyes, and neurological-muscle disorders such as cerebral palsy, Multiple Sclerosis, ALS, Parkinson’s, Muscular Dystrophy, muscle/skin inflammation, post-stroke syndrome, brain damage, etc. Additionally, one mouse study found although “Octacosanol does not alter normal sleep, it clearly alleviates stress and restore stress-affected sleep.”[155]

While pure Octacosanol can be processed for medicinal use, wheat germ oil comes with all the many phytochemicals and nutrients that boost its effects. Two teaspoons of wheat germ oil contain between 200 to 600 mcg of Octacosanol.

Contraindication: Wheat germ oil should never be given to those with wheat allergies or Celiac disease, or those with low blood pressure, or very low blood sugar levels. It should not be used in conjunction with the drug, levodopa. Discontinue use if skin irritation occurs, cholesterol levels rise, or there is gastrointestinal discomfort. If you use wheat germ oil, make sure it is organic, unrefined, cold-pressed, and pure.

FERMENTS

Fermented foods can be an amazing source of beneficial bacteria to benefit gut health. Fermentation is an enzymatic process that produces ATP (adenosine triphosphate) in an anaerobic environment. The science behind the fermentation process is called zymology. Fermentation stands out as one of the earliest and healthiest methods of food preservation that produces lactic acid, a natural preservative that inhibits the growth of putrefying bacteria. This is that sour taste one notices in fermentations such as pickles, cauliflower, broccoli, garlic, Kefir, kombucha, kimchi**,** miso, natto, raw cheese, sourdough bread, and yogurt.

"Scientists and doctors today are mystified by the proliferation of new viruses – not only the deadly AIDS virus but the whole gamut of human viruses that seem to be associated with everything from chronic fatigue to cancer and arthritis. They are equally mystified by recent increases in the incidence of intestinal parasites and pathogenic yeasts, even among those whose sanitary practices are faultless. Could it be that in abandoning the ancient practice of lacto-fermentation and in our insistence on a diet in which everything has been pasteurized, we have compromised the health of our intestinal flora and made ourselves vulnerable to legions of pathogenic microorganisms? If so, the cure for these diseases will be found not in vaccinations, drugs or antibiotics but in a restored partnership with the many varieties of *lactobacilli,* our symbionts of the microscopic world."[156]

Contraindications: Although sometimes confused with food allergies, it is possible that those with histamine intolerance may not be able to tolerate fermented foods. A histamine reaction does not always occur immediately after food, but is dependent upon histamine levels in the body. Symptoms occur such as anxiety, irritability, headache, hives, skin problems, face or throat swelling, nasal congestion, racing heart, indigestion, or red/watery eyes. This response is caused by elevated blood histamine levels due to an imbalanced gut microbiome, improperly digested food, and the resulting inflammation that builds up histamine in the intestines.[157] Therefore, while very beneficial to the body, not all people can tolerate fermented foods and beverages.

Apple Cider Vinegar (ACV)

Vinegar, in French, translates "sour wine." As a fermented food, you will want to use raw, unfiltered, apple cider vinegar with the "mother" which is the cloudy substance formed by natural enzymes during the fermentation process. For food consumption ACV is sold at five percent acidity.

Acetic acid is the main active compound in vinegar which is antimicrobial. It passes into cell membranes to destroy bacteria such as E. Coli and salmonella. (A great reason to use it on a salad!) The acetic acid content of ACV is also anti-glycemic, however, the mechanism remains unclear. It also appears to improve insulin sensitivity and may be beneficial to those with pre and type-2 diabetes. "One study found that taking two tablespoons if apple cider vinegar before bed lowered blood sugar levels in people with type 2 diabetes by up to 6 percent in the morning."[158] ACV also seems to increase satiety, which may be helpful for those with weight issues.

Apple Cider Vinegar is helpful in liver detoxification. It also has cleansing properties for the lymph nodes and stimulates the circulation of lymph positively affecting the immune system. ACV is rich in potassium which may prove beneficial in regulating blood pressure, muscle-building, nerve impulse transmission, hair loss, etc.

ACV is also a pH balancer, acidifies the stomach (helpful for settling heartburn) yet alkalinizes the body due to its ash content. One study showed that "Apple cider vinegar showed antifungal properties against Candida spp., thus representing a possible therapeutic alternative for patients with denture stomatitis."[159]

ACV must be diluted before ingesting or using topically. While it takes some getting used to, it is best to start slow around one teaspoon per glass of water and gradually increase up to two tablespoons per glass. Adding a teaspoon or so of unsweetened lemon juice, improves the flavor.

Beet Kvass

"Beetroot has been used since the Middle Ages as a treatment for ailments, particularly those relating to the blood and digestion."[160]

Beets are a blood and liver purifier. They are also chock-full of nutrients such as vitamins B-6 and C, folate (B-9), potassium, manganese, fiber, enzymes, and nitrates. These nitrates, when mixed with saliva are converted into nitrite which further converts into nitric oxide. Nitric oxide improves circulation by dilating blood vessels which reduces blood pressure. The betaine in beets protects against heart-disease by reducing inflammation. "A review of the potential benefits of beetroot and beet juice supplements, published in the journal Nutrients, found evidence that the betalains in beetroot juice can reduce inflammation in the body and protect DNA from oxidative damage. In addition, the phytochemicals in beets help to maintain healthy and more flexible blood vessels."[161]

"Beets and beet kvass are valued for their liver-cleansing properties and are widely used in cancer therapies in Europe. Anecdotal reports indicate that beet kvass is an excellent therapy for chronic fatigue, chemical sensitives, allergies, and digestive problems."[162] "This drink is valuable for its medicinal qualities and as a digestive aid. Beets are just loaded with nutrients. One 4-ounce glass, morning and night, is an excellent blood tonic, promotes regularity, aids digestion, alkalizes the blood, cleanses the liver and is a good treatment for kidney stones and other ailments. Beet kvass may also be used in place of vinegar in salad dressings and as an addition to soups."[163]

Contraindications: Those who are prone to calcium oxalate kidney stones should refrain. Consumption of beets can cause urine and stool to change color. A rare beet allergy may cause symptoms such as "redness, swelling or itching in the mouth, tongue or throat. In most people, symptoms are mild and clear up easily, but some people may have a more severe reaction, which can lead to anaphylaxis."[164]

Sauerkraut

"Tiberius always carried a barrel of sauerkraut with him during his long voyages to the Middle East because the Romans knew that the lactic acid it contained protected them from intestinal infections."

~ Annelies Schoneck *Des Cruities Toute L'Annee*

Sauerkraut, or 'fermented cabbage' is thought to be originally crafted by the Chinese and is exceedingly popular throughout Europe for at least a thousand years. The benefits of fermented foods, including sauerkraut include reduced inflammation of the GI tract as well as reducing inflammation systemically which is beneficial for arthritic symptoms including rheumatoid and juvenile arthritis. It effectively works to heal gastrointestinal disorders such as IBS, diarrhea, ulcerative colitis, and leaky gut which in turn boosts the digestion and ability to absorb food nutrients, improves immunity, and protects against microbe imbalances such as H. pylori.

Additionally, sauerkraut and its beneficial bacteria also work to balance hormones and support brain health and ease mood disorders and anxiety. Because of its ability to control inflammation and detoxify the liver (and the body) sauerkraut has been found helpful in resolving asthma and even food allergies. "Eating a small amount daily — just several tablespoons — provides a great source of nutrients, including vitamin K, vitamin C, calcium, potassium and phosphorus — and, of course, probiotics."[165]

"Dr. Mercola sent his sauerkraut off to a lab and reported the findings of probiotics saying, 'We had it analyzed. We found in a 4-6 ounce serving of the fermented vegetables there were literally ten trillion bacteria.' That means 2 ounces of home fermented sauerkraut had more probiotics than a bottle of 100 count probiotic capsules. Translated this means one 16 ounce of sauerkraut is equal to 8 bottles of probiotics."[166]

Sauerkraut, has been found to feed "the enteric neurosystem which connects the intestinal tract to the brain linking psychiatric disorders to the gut. 'If the gut is still damaged, if the gut flora is still abnormal this river of toxicity continues flowing from the gut to the brain. Toxicity builds up again so the (person) slides back to whatever the disorder is" states Doctor Natasha Campbell-McBride, MD.[167]

What is most exciting is that your own homemade sauerkraut has been found to have more beneficial bacteria than any fermented cabbage product sold in stores. Making sauerkraut is an inexpensive way to boost your own health!

FIBER

Glucomannan

Glucomannan is a dietary fiber made from the root of the konjac (*Amorphophallus konjac*) plant also known as Elephant Yam. Clinical studies have demonstrated that Glucomannan can provide temporary relief of constipation and supports healthy cholesterol levels. Additionally, as Glucomannan may help to promote satiety (the feeling of fullness), for some people it may be an effective addition to a weight loss plan.

Glucomannan powder takes on the flavor of whatever it is cooked with. Glucomannan must be taken along with sufficient liquid. It is "bulk-forming" and will expand when it comes into contact with water. Glucomannan is available in powder, capsules, and tablets.

Contraindications: Sufficient water intake is necessary when taking glucomannan. For some, glucomannan may cause temporary side effects of gas, bloating, or diarrhea. After a few weeks, side-effects caused by the introduction of additional fiber into the diet, should disappear. Glucomannan can reduce the absorption of certain medications.

Flaxseed

As a beneficial source of fiber, flaxseed provides the highest level (26%) of dietary fiber found in any food. It also contains 12% of highly beneficial soluble fiber and 12% of insoluble fiber, both of which are necessary for good health. Insoluble fiber is beneficial for weight loss and can help prevent constipation in those with diverticulitis or irritable bowel syndrome (IBS).

Flaxseed can also lower cholesterol and soothe and cleanse mucus and wastes from the GI tract while providing bulk and moisture to the stool which helps it to soften it so that it can pass more quickly. Its mucilage is soothing and healing to the intestinal tract and it is safe to eat during pregnancy. As with all sources of fiber, it is important to consume adequate water as they are absorbent.

"If you choose to add flaxseed to your diet, ground seeds are preferred, as they allow better absorption of the omega-3 fats and the lignans. Most people start with 1 tablespoon a day, mixing it in oatmeal, yogurt, salads or cooked grains. Flaxseed oil does not contain lignans and fiber, unless these are added."[168]

Oat Bran

Oat Bran (Avena sativa) is the outer layer of the oat grain that lies under the inedible outer hull. Groats are what is left when the bran and the hull are removed and is processed to make oatmeal. The bran offers increased blood glucose control, lowers blood pressure, is anti-oxidant and anti-inflammatory, anti-cancer, reduces cholesterol, and resolves constipation.

Contraindications: Sufficient water intake is necessary when taking oat bran. Excessive dosing can lead to diarrhea, bloating, flatulence, and intestinal occlusions.

Pectin

Pectin is a water-soluble plant-based fiber that thickens to the consistency of a gel when water is added. It can be substituted for gelatin in recipes. Pectin slows down the absorption of food, which is especially beneficial to diabetics in leveling out blood sugar spikes. A type of carbohydrate called a polysaccharide that is found in fruits and vegetables, pectin also contains some fiber.

It may be beneficial for weight loss because it increases satiety, lowers cholesterol, and may even regress gallstones. Perhaps the most beneficial aspect of pectin is that it promotes detoxification of toxins and heavy metals and can even reduce the side-effects of medical therapies that include radiation.

Food sources: apples, beets, bananas, cabbage, carrots, dried peas, grapefruit, green beans, lemons, limes, okra, oranges, passionfruit, peaches, potatoes, raspberries, strawberries, and tomatoes.

Psyllium Hulls/Husk

Psyllium seed (*Plantago ovata*) is a bulk-forming laxative that works by soaking up fluid in the gut to make bowel movements much easier (and without flatulence). It may be beneficial for cancer, colitis, constipation, Crohn's disease, diabetes, diarrhea, diverticulosis, hemorrhoids, heart disease, hypertension, IBS, kidney stones, peptic ulcer, PMS, and weight control. Psyllium is also a prebiotic (food for probiotic bacteria). (See PREBIOTICS.)

Contraindications: Psyllium can bind to medications so that they are not absorbed by the body. If consumed in excess before or soon after a meal, may produce hypoglycemia. Other possible side-effects when taken in excess includes abdominal pain and cramps, allergies, choking, diarrhea, frequent bowel movements, nausea and vomiting, and stomach pain.

HORMONES

DHEA (Dehydroepiandrosterone)

After approximately age 30 the body's production of DHEA begins to decrease. As a steroid hormone DHEA is produced by the adrenal glands and converts into the sex hormones estrogen and testosterone. It is believed that DHEA can give a significant boost to the immune system and works in an anti-aging manner building muscle and increasing the rate of metabolism and libido.

DHEA May Improve

- AIDS
- Addison's Disease
- Alzheimer's
- Anorexia
- Atherosclerosis
- Cancer
- Chronic Fatigue
- Crohn's Disease
- Depression
- Diabetes Type II
- Erectile Dysfunction
- Immunity
- Kidney Disease
- Life Span (in lab animals)
- Lupus
- Stress Management
- Mobility
- Memory
- Menopause
- Menstrual Cycle Irregularities
- Mobility
- Multiple Sclerosis
- Myotonic Dystrophy
- Osteoporosis
- Pain
- Quality of Sleep
- Sense of Wellbeing
- Schizophrenia

DHEA supplementation as many positive effects, however, it should be used with caution. There is concern that at high doses, DHEA can suppress the ability of the body to synthesize its own and that it has potential to damage the liver. Estrogenic or testosterogenic tumors may experience accelerated growth from DHEA supplementation. DHEA should be taken with vitamins C and E and the mineral selenium to prevent free radical damage to the liver.

Melatonin (*N*-acetyl-5-methoxytryptamine, MLT)

Melatonin is an antioxidant hormone released by the pineal gland that also enhances the antioxidant effects of certain enzymes. It is involved in the regulation of hormone secretion and has been found to be especially important to the sleep-wake cycle otherwise known as the circadian rhythm. When working properly, melatonin levels are increased in the evening in response to darkness to induce sleep. Those levels are then suppressed during daylight hours when the body awakens.

"At night, your body uses serotonin to create melatonin, a chemical that plays a key role in mediating our circadian rhythm. Our body naturally produces melatonin at night, causing us to get sleepy. Increasing melatonin levels at night using a supplement like 5-HTP may help treat sleep disorders like insomnia."[169] L-Tryptophan is the precursor to 5-HTP (and melatonin) which may be a beneficial supplement to try before progressing on to melatonin.[170]

"Melatonin supplementation is only effective as a sedative when the pineal's own production of melatonin is very low. However, low melatonin levels are an extremely common cause of insomnia in the elderly."[171] Substances that can decrease the production of melatonin include alcohol, aspirin, caffeine, ibuprofen, and nicotine. Artificial light, as a stimulant to the brain, interferes with the production of melatonin as do certain prescription medications such as beta blockers, calcium channel blockers, and tranquilizers.

Melatonin can be helpful for sleeplessness resulting from aging, benzodiazepine withdrawal (to wean off of sleeping pills), cancer, cluster headaches, high blood pressure, jet lag, radiation exposure, smoking cessation, Tardive Dyskinesia, and Thrombocytopenia. It may be helpful for helping to prevent the spread of breast, prostate, lung, and skin cancers. In vitro studies show melatonin may have antitumor effects in melanoma and in human breast cancer as it interferes with estrogen receptor expression.

It is good to remember that melatonin is not a "sleeping pill", rather it is a stress hormone designed to support the body's biological clock, not to increase the desire or need for sleep. For a deeper explanation about the cause and correction of insomnia and resulting sleep debt, click on the following links: **Sleep Much? (Part I)** **&** **Sleep Much? (Part II)**

Contraindications: Do not take if pregnant or lactating. Women trying to conceive should avoid as high doses may suppress ovulation. Those taking dexamethasone and cortisone should avoid melatonin without a doctor's prescription. Supplementation should only occur for a short time while the underlying condition is being resolved.

Pregnenolone

Pregnenolone blocks the effects of cortisol and stimulates brain NMDA receptors which influence cognitive function, learning, and memory which decline with age. It may help reduce stress, arthritic inflammation, enhance mood, fatigue, repair degenerated myelin sheath in multiple sclerosis (in animal studies), spinal cord injury, reverse paralysis (if given shortly after injury), symptoms of schizophrenia, vision, and increase sensitivity to smell.

"Unlike DHEA, which converts to estrogen and testosterone, pregnenolone is converted directly to progesterone. This makes it an excellent choice for estrogen-sensitive women or testosterone-sensitive men (such as those with a history of or who may be at risk for prostate cancer.)"[172]

Contraindications: Do not take when pregnant or breast-feeding. For short-term use only. Side-effects include: "skin rashes, acne, hair loss, diarrhea or constipation, problems sleeping, restlessness, agitation, sweating, or tremor. It may also cause palpitations (irregular heart beat), depressed mood, both increased or decreased appetite, or muscle pain."[173]

Progesterone

Progesterone is a steroid hormone produced in the female body by the corpus luteum, a temporary endocrine gland appearing after ovulation. It is also produced in the ovaries. Low levels of Progesterone can lead to infertility, uterine bleeding and other complications. In

postmenopausal women who receive estrogen hormone replacement therapy, Progesterone is used to prevent an overgrowth in the lining of the uterus.

Some women have a tendency to be hospitalized from asthmatic attacks during the menstrual and premenstrual times when hormones are low. Progesterone, a smooth muscle relaxant, may be of benefit as "Stabilizing hormone fluctuations… improves pulmonary function and reduces the need for medication."[174] Transdermal Progesterone may be helpful for some women who have migraines linked to pre-menstruation.

There is a common misconception that Wild Yam (*Dioscorea villosa*) is a source of progesterone when in fact, it is not. The dried root (rhizome) of Wild Yam contains diosgenin which is a phytoestrogen. Diosgenin can be chemically converted to the hormone progesterone in a lab, as the body is not able to make this conversion.[175] While there may be supplements labeled as "natural" progesterone with good ingredients, the progesterone – even if derived from Wild Yam will have been chemically processed in a lab.

Contraindications: Common side effects include: abdominal cramps, depression, dizziness, and headache. Additional side effects include anxiety, cough, diarrhea, fatigue, musculoskeletal pain, nausea, bloating, emotional lability, and irritability.[176]

MICROALGAE

Spirulina	VS.	Chlorella
Spiral-shaped		Spherical-shaped
Multi-celled Plant		Single-celled microorganism
No Nucleus		Has Nucleus
Blue-green Color		Green Color
Cellulose Wall		Hard Indigestible Cell Wall
Easily Digested		Cell Wall -> Cracked to Digest
Lower in fat and calories		Higher in fat and calories
High in absorbable protein		High in antioxidants
Richest source of beta - carotene (10x carrots)		Highest amount of chlorophyll of any plant
Contains more essential amino acids, iron,copper, Vitamin A, B (especially thiamine), C, D, E, & K		Slightly more omega-3 fatty acids, provitamin A, riboflavin, vitamins B, C, D, E, K and the minerals phosphorus, calcium, magnesium, iron, and zinc

Chlorella

Chlorella (*Chlorella vulgaris*) is a single-celled, green, freshwater microalgae. It is a source of chlorophyll (a protein), magnesium, and amino acids. The supplement contains amino acids, peptides, vitamin K, vitamin B12, folate, iron, and minerals. Chlorella is also a source of omega-3 fatty acids. It is considered to be a detoxifier as it binds to heavy metals and destructive chemicals in the body.

This study reveals the effectivity of chlorella (and sulfur) in the chelation of mercury (Hg), silver (Ag), tin (Sn), lead (Pb), and uranium (U) in people who have had dental amalgams and titanium implants for an average of 12 years. Not only did the chlorella help reduce heavy metals, SuperOxide Dismutase (SOD) activity was increased which boosted antioxidant effects.[177]

Chlorella may be helpful to stimulate good bacteria production in the intestines and affect skin lesions, may be beneficial for diarrheal disorders, ulcerative colitis, Crohn's, and diverticulitis. It may even remove inflammation that precipitates asthma attacks, help with PMS and fibromyalgia, and eliminate halitosis. It also contains 'chlorella growth factor' which may repair damaged nerve tissues and increase cell production.

Cancer or HIV sufferers may find chlorella useful for increasing white blood cells. Breast cancer sufferers were found to have less fatigue, and the negative side-effects of chemotherapy and radiation were lessened. "A 2009 Journal of Zhejiang University Science B study revealed that chlorella vulgaris extract inhibited the development of tumors and triggered apoptosis or cell death in liver cancer-induced rats."[178]

In addition to heavy metals, Chlorella eliminates pathogens such as the sexually-transmitted trichomoniasis, and also reduces the chances of having immune system disorders. Blood sugar levels are helped as the body's sensitivity to insulin is increased resulting in normalized blood sugar levels and improved fat metabolism. It can decrease triglycerides and total cholesterol, supports and cleanses the bowel, the liver, and the blood, removes molds, and regulates blood pressure as it contains gamma-aminobutyric acid (GABA).

Chlorella supplements come in a powder, tablets, or liquid extract. Select a high-quality product that is organic, contains no additives, and has a "broken cell wall" or is "micronized" to aid digestion and assimilation of nutrients. When beginning supplementation start slow and build tolerance to avoid nausea, gas, stomach cramps, diarrhea, photosensitivity, or green stool color.

Contraindications: Do not take if you are pregnant or breastfeeding, have mold allergies, are severely immunocompromised, sensitive to iodine, or taking anticoagulant drugs. As chlorella can contain iron, men, and non-menstruating women may want to monitor serum iron levels.

Spirulina

Spirulina (*Arthrospira platensis*) and (*Arthrospira maxima*) is a blue-green freshwater and/or saltwater microalgae. It is the most nutrient-dense food packed with phytonutrients, omega-3 fatty acids, omega-6 fatty acids, riboflavin, thiamin, niacin, pantothenic acid, vitamin K, vitamin E, folate, vitamin B6, Vitamin C, vitamin A, the minerals: copper, iron, manganese, magnesium, sodium, potassium, zinc, phosphorus, calcium, and selenium, and the fatty acid gamma-linolenic acid (GLA).

Like Chlorella, Spirulina will bind to heavy metals and destructive chemicals and can be helpful to detox heavy metals, especially organic arsenic (As) which is naturally present in high levels within the United States.

An April 2016 study[179] by researchers at Dartmouth College found "that the inorganic arsenic levels in babies' urine was much higher in those who ate rice-based cereals and snacks when compared to babies who didn't eat these rice-containing foods. This is a big deal, because 80 percent of babies eat rice cereal during their first year of life. Previous studies suggest that exposure to arsenic early in life may lead to adverse developmental effects. … People

consume the most rice relative to their weight when they are just 8 months old, thanks to the rise in popularity of rice-based baby cereals and snacks."[180]

Additionally, Spirulina is helpful for fighting allergies, boosting immunity, and has higher concentrations of phytochemicals that may be helpful to prevent cancer.

Spirulina supplements come in a powder, tablets, or flakes. The beneficial amount for most studies was when consuming from 1-8 grams daily. One tablespoon is approximately 7 grams. Start low and work up to the preferred daily dosage.

To avoid potential dangers, it is best to choose a product from a trusted manufacturer that uses third-party testing. Products carrying the NSF or USP seal generally set quality standards for supplements.

Contraindications: Pregnant/lactating women and children should not take algae. Autoimmune reactions have been reported by certain individuals, conversely others have been helped. Caution is advised.

PHYTONUTRIENTS & PHYTOCHEMICALS

Phytonutrients

"Phyto" is the Greek word for plants. Phytonutrients are the beneficial chemical compounds that come from plants. Most people have heard of vitamins and minerals which are the phytonutrients. However, not all people realize that there are thousands of additional compounds in plants that work alongside vitamins and minerals necessary for the proper functioning of the body. Some of the most important phytonutrients are carotenoids, curcuminoids (such as those found in turmeric), ellagic acid, flavonoids, resveratrol, glucosinolates, and phytoestrogens. See the discussion on ellagic acid and resveratrol under Antioxidants: Antioxidant Oligomeric Proanthocyanidins.

Phytochemicals are usually differentiated from phytonutrients because their effects on the body, especially in high amounts may not always be beneficial. In other words, phytonutrients are always phytochemicals, but phytochemicals are NOT always phytonutrients. Some phytochemicals are known as antinutrients. These are plant compounds that interfere with the absorption of nutrients, sometimes because they hinder the work of digestive enzymes, other times they bind to nutrients preventing them from proper absorption. Antinutrients may be beneficial in when consuming foods in moderate amounts and toxic in high amounts. They are naturally found at low enough levels that the benefits of the entire food far outweigh any potential negative effects.

Flavonoids (Bioflavonoids)

Flavonoids are the yellow color found in the petals of flowers that serve in UV filtration, nitrogen fixation, and an attractant for pollinators. They are also chemical messengers, cell cycle inhibitors and physiological regulators for the plant. In the body, flavonoids, reduce the risk of cancer, heart disease, asthma, and stroke. Flavonoid intake has been associated with a significant reduction in coronary heart disease mortalities.[181] Additionally, scientists "have found that certain flavonoids have antihistamine, antimicrobial, memory- and even mood-enhancing properties."[182] As the phytochemicals known as flavonoids work to enhance cellular communication detoxification ensues. This results in reduced inflammation. (See Antioxidants: Quercetin)

Carotenoids

Carotenoids are the antioxidant pigments that give fruits and vegetables their bright orange, red, yellow, purple, and blue colors. Dark green vegetables have carotenoids too, but the abundance of chlorophyll hides them. The yellow and orange pigments are Alpha-carotene, beta-carotene, and beta-cryptoxanthin which the body can convert into vitamin A, is necessary for the immune system and for eye health. Found in carrots, pumpkins, sweet potatoes, etc.

Lutein & Zeaxanthin

Lutein and Zeaxanthin give vegetables their green or orange colors. They are supportive good eye health, preventing cataracts and macular degeneration. So eat your spinach, kale, and collards!

Lycopene

Lycopene is found in pink or red pigments found in tomatoes, watermelon, and pink grapefruits. There is a link between lycopene and a lower risk of prostate cancer.

Glucosinolates

Glucosinolates (the mustard oils) are nutritional, bitter, organic sulfur compounds (see sulforaphanes) with antibiotic-type effects that help ward off fungal, bacterial, and viral infections in the GI tract. Glucosinolates also seem to have the ability to detoxify the body of carcinogens.

Food Sources: cruciferous vegetables

~ Cruciferous Vegetables

Cruciferous vegetables are rich sources of sulfur-containing compounds. Whenever raw cruciferous vegetables are chewed or chopped compounds called glucosinolates are activated. Glucosinolates have an insecticidal action for the plant. For the human, the ingestion of glucosinolates through raw cruciferous vegetables is beneficial as they have anticancer, anti-fungal, anti-microbial, and anti-inflammatory actions. This translates into improved cardiovascular health, reduced inflammation, and weight loss. Glucosinolates are found in broccoli, broccoli sprouts, kale, cauliflower, cabbage, black radish, nasturtium, turnips, horseradish, and mustard greens.

An "article published by the Department of Epidemiology at the Institute of Pharmacological Research in the Oxford Academic Annals of Oncology in 2012 reported that "the regular intake of cruciferous foods offered between a 17 percent and 23 percent reduction in the risk of colorectal, breast, kidney, esophageal, and oropharyngeal (mouth and throat) cancers."[183]

Thiocyanates (isothiocyanates) are colorless sulfur compounds found in cruciferous vegetables. Within the human body thiocyanate can also be produced in the metabolism of cysteine and detoxification of cyanide, and then secreted in urine. "Isothiocyanates are toxic to the plants that produce them. Due to this, they are stored as part of a larger molecule called a *glucosinolate*. In this form, they are inactive. The attack of the plant by something that chews its tissues, such as a caterpillar, releases an enzyme called a *myrosinase*. This enzyme breaks down the glucosinolate, releasing an isothiocyanate to drive the attacker away."[184] Isothiocyanates, while toxic in large amounts, are known to have anti-cancer properties at the concentrations found in food.

"The main component of nasturtium oil (*Tropaeolum majus*) is benzyl isothiocyanate, which has potent antibacterial and antifungal activity. In Europe, enteric-coated capsules of this oil are used to treat bronchial and urinary tract infections."[185]

continued…

Cruciferous Vegetables continued.

While there are benefits to eating moderate amounts of cruciferous vegetables, goitrogens can interfere with thyroid function. "The ingestion of large amounts of food containing glucosinolates may reduce intake, cause thyroid gland hypertrophy, and reduce levels of circulating thyroid hormones, mainly by inhibiting the iodine uptake by the gland."[186] Be sure to have adequate daily intake of iodine and should you have thyroid issues, cook cruciferous vegetables prior to eating them. This will reduce their goitrogenic effects.

Thiocyanates

Thiocyanates are colorless potassium and sodium salts that occur when oxygen is replaced by sulfur. Thiocyanate was previously known as rhodanide (the Greek word for rose) due to the red color of its iron complexes. It is an antibacterial, antifungal, and antiviral compound that is secreted across the epithelium.

Thiocyanate overload occurs when naturally occurring goitrogens are overconsumed or when certain environmental toxins such as cigarette smoke inhibit the thyroid from absorbing iodine.

Food Sources: broccoli, Brussels sprouts, cabbage, cassava, cauliflower.

Phytoestrogens

Phytoestrogens are plant-based estrogens secreted by plants as a protective measure that work to modulate the fertility of animals that would eat them. They do this by attaching themselves to estrogen receptors thereby increasing overall estrogen levels in the body. Isoflavones are the most common compounds found primarily in soy and red clover.

Extra estrogen in a young women's body can lead to irregular periods, spotting or heavy bleeding, premenstrual syndrome, low sex drive, hair loss, fatigue, infertility, polycystic ovaries, estrogen-based cancers such as breast or ovarian cancer, and more. Men and boys do not require extra estrogen in their bodies either. Unopposed estrogen in males may lead to depression, erectile dysfunction, infertility, and gynecomastia (enlarged breasts). Other health problems associated with estrogen dominance include: blood clots, heart attacks and strokes, and diseases of the thyroid.

Foods that may be helpful in reducing estrogen levels in the body include cruciferous vegetables, mushrooms, whole grains, flaxseeds, and red grapes. Lifestyle changes such as losing weight if one is overweight or obese may be helpful as fat cells are capable of producing additional estrogen. Some medications increase estrogen levels such as some antibiotics, phenothiazines, and hormone-based contraceptives.

Herbal remedies that increase estrogen are black cohosh, vitex (chaste tree berry), damiana, licorice, red clover, and evening primrose. For some women, particularly those who are menopausal with lowered estrogen levels, evening primrose may be helpful and it is also very nourishing to the ovaries.

~ Soy

The oriental tradition of processing soy using a long period of fermentation creates non-toxic foods which include miso, natto, tempeh, soy sauce, fermented bean paste, and pickled tofu.

The "production of modern soy protein products takes place in industrial factories where a slurry of soy beans is first mixed with an alkaline solution to remove fiber, then precipitated and separated using an acid wash and, finally, neutralized in an alkaline solution. Acid washing in aluminum tanks leaches high levels of aluminum into the final product. The resulting curds are spray-dried at high temperatures to produce a high-protein powder. A final negative process to the soybean is high-temperature, high-pressure extrusion processing of soy protein isolate to produce textured vegetable protein (TVP). …high-temperature processing has the unfortunate side-effect of so denaturing the other proteins in soy that they are rendered largely ineffective. Nitrites, which are potent carcinogens, are formed during spray-drying, and a toxin called lysinoalanine is formed during alkaline processing."[187]

It is also of concern that 94 percent of the U.S. soybean crop is genetically engineered and therefore, heavily sprayed with carcinogenic glyphosate that does not wash off, but rather absorbed into the soybean. Many modern soy products do not use traditional and proven processing techniques and are not safe for animal or human consumption.

Estrogen Dominance – Used in most commercially prepared foods, soybeans and soy products are the highest sources of phytoestrogens in the human diet. Some isoflavones are also known as phytoestrogens because they act as estrogen in the body. "A leading cause of breast cancer[188], endometriosis, uterine fibroids, infertility, and low libido is unopposed estrogen."[189] "Buddhist monks and other such groups traditionally consumed tofu and other soy foods to suppress libido and reproductive functioning."[190]

More recently there was the case of a 19-year-old man with "sudden onset of loss of libido and erectile dysfunction after the ingestion of large quantities of soy-based products in a vegan-style diet." After stopping the diet it took a full year for his testosterone to normalize and sexual function to be regained.[191]

Inflammation-Producing – Soy oil, while once thought to be "heart healthy" causes chronic inflammation due to its high 'omega-6 to omega-3 ratio of 7.5:1"[192]

Thyroid Suppressing – "Soy phytoestrogens are potent antithyroid agents that cause hypothyroidism and may cause thyroid cancer. In infants, consumption of soy formula has been linked to autoimmune thyroid disease."[193]

Enzyme (Kunitz)-Inhibitors – The enzyme Trypsin is needed for the proper digestion of protein. This interferes with the availability of the amino acid Methionine essential for the production of cysteine, taurine, SAM-e, and the antioxidant glutathione. Symptoms that result are stomach cramps, diarrhea, bleeding, and eventually pancreatic dysfunction.

Nutrient Deficiencies – No other grain or legume has as high a phytic acid content as does soy. "This anti-nutrient binds to important minerals like iron, calcium, magnesium, and zinc and limits their absorption."[194] Unlike other legumes and grains with phytates, the phytate content of soy can only be reduced through fermentation.

Berberine

Berberine is a water-soluble, plant-based alkaloid that is yellow in color and found in herbs such as Oregon Grape, Goldenseal, and Barberry, etc. It has "anti-inflammatory, anticarcinogenic, antibacterial, antimalarial, anti-amoebic, and antifungal properties; it is also a prostate and urinary tract antispasmodic. In addition, this compound has demonstrated cardiovascular activity, having positive inotropic, negative chronotropic, antiarrhythmic and vasodilating properties."[195]

Berberine can reduce fasting blood sugar levels, decrease insulin resistance, decrease the liver's sugar production, increase beneficial bacteria in the gut, and slow the breakdown of carbohydrates in the gut. It has been found to reduce blood sugar levels in type 2 diabetics as effectively as pharmaceutical Glucophage. "According to a big review of 14 studies, berberine is as effective as oral diabetes drugs, including metformin, glipizide and rosiglitazone."[196]

One meta-analysis concludes: "This study indicates that berberine has comparable therapeutic effect on type 2 DM, hyperlipidemia and hypertension with no serious side effect. Considering the relatively low cost compared with other first-line medicine and treatment, berberine might be a good alternative for low socioeconomic status patients to treat type 2 DM, hyperlipidemia, hypertension over long time period."[197] Another study concludes, "this pilot study indicates that berberine is a potent oral hypoglycemic agent with beneficial effects on lipid metabolism. Total cholesterol and low-density lipoprotein cholesterol were decreased significantly as well."[198] Berberine is also a choleretic that can triple bile secretion for up to 1.5 hours. Additionally, it has been tested and found to be antimicrobial against all tested strains of MRSA.

Contraindications: Berberine is contraindicated in pregnancy as it may stimulate the uterus. There may be passing adverse gastrointestinal effects. Short-term use is recommended; however, long-term use is not to be encouraged as it could cause bradycardia and neurotoxicity. Using the whole herb including the leaves is protective, whereas, an isolated Berberine extract would not have those protections.

Betaine Anhydrous

Betaine Anhydrous or trimethylglycine (TMG) was first discovered in sugar beets (*Beta vulgaris subsp. vulgaris*). It is an amino acid called 'glycine betaine' to distinguish it from other betaines that are widely distributed in other microorganisms, plants, etc.

Betaine works in the body to reduce homocysteine into L-methionine which is cardioprotective. (In those with cardiovascular health issues homocysteine levels are raised, but it is not known whether elevated homocysteine is only an indicator or whether it is an actual promotor of cardiac dysfunction.) It can also increase SAMe or active folate. In this way, betaine directly supports homocysteine reduction and indirectly supports methylation of the whole body. Betaine is also known as an 'osmolyte', which is a molecule that regulates the balance of water within cells.

Another health benefit of betaine is in the treatment of fatty liver (and corresponding liver fibrosis) when taken at relatively high doses.

Contraindications: May cause gastrointestinal upset, nausea, and in rare situations diarrhea. Not intended for pregnant or lactating women, those with kidney disease, or those with homocystinuria.

Betaine HCl

The production of stomach acid tends to decline with age. Betaine Hydrochloride (HCl) a laboratory made chemical formulation designed to support proper digestion by increasing stomach acid and stimulating the release of digestive enzymes. It is also used for "abnormally low levels of potassium (hypokalemia), hay fever, "tired blood" (anemia), asthma, "hardening of the arteries" (atherosclerosis), yeast infections, diarrhea, food allergies, gallstones, inner ear infections, rheumatoid arthritis (RA), and thyroid disorders. It is also used to protect the liver."[199]

Contraindications: This product is for adults only and not for pregnant or nursing women. Large doses will cause heartburn.

Calcium-D-Glucarate

Calcium D-Glucarate is a synthetic formulated chemical resembling glucaric acid that is found in the human body and in certain foods. It supports the body in the conversion of glucaric acid a chemical in the intestine that is liver-supportive. The natural chemical, Glucaric acid is not available in supplement form.

While not a significant source of calcium, Calcium D-Glucarate, contains glucarate which is most beneficial. As a cellular detoxifier, it works through the process called 'glucuronidation' which "is a detoxification process where a group (known as a glucuronide) is attached to a hydrophobic molecule to make it more water soluble, and then the kidneys can better facilitate its removal from the body."[200]

As a β-glucuronidase inhibitor Calcium-D-Glucarate facilitates the excretion of any molecule within a specific detoxification pathway. While high oral doses such as those needed for the remediation of cancer, are impractical Calcium-D-Glucarate is an effective hormone balancer which may reduce steroid hormones.

Food Sources: bean sprouts, lettuce, broccoli, kale, cabbage (the cruciferous vegetables) and fruits like tomatoes, cherries, grapes, and oranges.

Contraindications: "All steroid hormones in the body (testosterone, estrogen, DHEA, etc.) are also glucuronidated. If using an oral dose that reduces the toxin, these hormones will also all be reduced for a short time. Using calcium-D-glucarate as a daily preventative supplement does not appear to be a prudent idea, due to its lack of reliability even in theory and high doses used. However, a single acute dose of this supplement prior to *known* exposure to toxins that are glucuronidated (such as both benzopyrene and polyaromatic hydrocarbon compounds produced in the cooking of meat products) might be more prudent and potentially useful."[200]

Choline

Choline is an essential nutrient in the B-vitamin family that can be made in the liver. "Choline is needed for the proper transmission of nerve impulses from the brain through the central nervous system, as well as for gallbladder regulation, liver function, and lecithin formation. It aids in hormone production and minimizes excess fat in the liver because it aids in fat and cholesterol metabolism."[201]

Deficiency is known to result in both liver and kidney disorders. "Healthy humans with normal folate and vitamin B12 status who were fed a choline-deficient diet developed liver damage…a diet deficient in choline has major consequences including hepatic, renal, pancreatic, memory, and growth disorders…Choline deficiency causes cancer in rodent models."[202]

Choline taken together with Inositol is a powerful nootropic combination capable of boosting motivation and memory, as well as increasing focus and cognitive function. Choline is known to work in the brain by increasing acetylcholine. "Increased choline intake has recently been recommended by the Food and Nutrition Board of the National Academy of Sciences for pregnant and nursing women to help ensure fetal brain development."[203] Postmenopausal women may need more choline than others.

Choline May Improve

- Acute Viral Hepatitis
- Alcohol-Induced Fatty Liver
- Alzheimer's
- Bipolar Depression
- Bodybuilding (delaying fatigue)
- Cardiovascular
- Certain Cancers
- Cirrhosis of the Liver
- Cognitive Disorders
- Diabetic Fatty Liver
- DNA Repair
- Drug-Induced Liver Damage
- Gastric Ulcers
- High Cholesterol
- Hypertension (weak capillaries)
- Inability to Digest Fats
- Memory
- Nervous System Disorders
- Parkinson's
- Tardive Dyskinesia
- Toxic Liver Damage

Food sources with the highest amounts of choline are: beef liver, coffee, grape juice, iceberg lettuce, lecithin, meat, peanut butter, and peanuts. Other sources are egg yolks, grains, legumes, lettuce, cauliflower.

Contraindications: Excessive amounts of choline may cause pain and bloating, nausea, diarrhea, depression, dizziness, and a fishy odor (a dose over 20 grams), reduced appetite. Contraindicated for those with clinical depression. Not appropriate for pregnant or lactating women.

Cilantro

Cilantro (*Coriandrum sativum*) is an herb with a multitude of health benefits. The name 'cilantro' and 'Chinese parsley' are used when speaking of the leaves for food or medicine, and 'coriander' is the name

given to the seed the cilantro plant produces. Generally, coriander is used in culinary applications.

Cilantro contains the minerals potassium, calcium, magnesium, manganese, and iron; as well as the vitamins A, B, C, and K. It also has polyphenolic flavonoids like quercetin. Its actions are antibacterial, antifungal, antioxidant, and antiseptic. It is also carminative (expels gas), stimulant, and aromatic. One of the primary uses for cilantro is for support during heavy metal detox as it binds and detoxifies heavy metals from the brain. It is also used for viral conditions and for nervous system disorders which can be linked to heavy metal poisoning.

Also, potentially useful in epilepsy cilantro leaf has been found to contain a "potent potassium channel-activating anticonvulsant."[204]

Cilantro (Leaves & Stem) Essential Oil. The essential oil is beneficial through diffusion or inhalation, and topical application. Essential oil of cilantro is a blood purifier that also stimulates lipolysis making it useful for weight loss through the breaking down cholesterol and fats.

Coriander (Seeds) Essential Oil. Coriander essential oil is beneficial for digestion as it can relieve gas pain and increase enzyme secretion, as well as relieve indigestion. It may boost libido, lift mood, stimulate the release of hormones, relieve spasms and chronic coughs, and may be important as part of an anticancer protocol.[205] It also is a strong antifungal. Additionally, coriander essential oil is recognized for its antimicrobial action and has been found able to reduce cell adhesion against uropathogenic E. coli.[206]

Contraindications: Medicinal use of cilantro may cause photosensitivity, and skin reactions such as itching or hives. It is important to source cilantro that has been prepared in non-aluminum cookware.

Diindolylmethane (DIM) (Also see Indole-3-Carbinol.)

3,3′-Diindolylmethane (DIM) is a compound derived from the digestion of indole-3-carbinol that is found in cruciferous vegetables such as broccoli, Brussels sprouts, cabbage, and kale. This supplement has a positive role in modulating estrogen-dependent cancers such as breast cancer. It also shows promise when taken during chemotherapy although proper dosing still needs to be worked out.

While it is best to have a lifetime of eating proper nutrients, DIM may be an effective way to reverse other cancers such as colon, uterine, prostate, pancreatic, leukemia, and cervical cancer. Intravaginal DIM suppositories have been demonstrated as effective for destroying cancer cells and reducing swelling and may be helpful for premenstrual syndrome (PMS), dysplasia, endometriosis, breast pain, and weight loss without negative side effects.

"What dosage of DIM supplement proved beneficial in these studies? The *Nutrition Reviews* study found that the microencapsulated DIM or BioResponse-DIM in a dose of 300 milligrams showed the most effective response."[207]

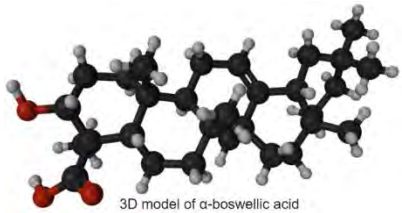
Food Sources: Brussels sprouts, broccoli, broccoli sprouts, cabbage, cauliflower, kale, and watercress.

Contraindications: DIM is considered "possibly safe for most people when taken by mouth short-term for medicinal purposes. The most common side effects include headache, nausea, vomiting, gas, and diarrhea. Taking larger doses of diindolylmethane is POSSIBLY UNSAFE. Taking 600 mg of diindolylmethane daily has been reported to lower sodium levels in some people."[208] When consumed in the small amounts from food, DIM is considered likely safe for children, and pregnant, and lactating women. There is the possibility that DIM may act as estrogen in hormone-sensitive condition although research also suggests DIM could possibly be protective. Due to the conflicting information, use with caution.

Essential Oils (EOs)

Essential oils are volatile (meaning they readily pass of in the form of vapor) aromatic (fragrant; odoriferous) oils that are extracted only from plants containing such molecules. Of those plants that contain aromatic oils, only the lightest (those having a molecular weight of less than 300) can be transferred out of the plant with the steam. Therefore, the extracted essential is only a portion of the constituents of the whole plant.

Understanding this can have life and death ramifications. When considering frankincense essential oil in its relationship to cancer it is helpful to know the following. For instance, boswellic acid, an anti-tumor component of frankincense gum resin has a heavier molecular weight (approximately 400 – 500). This is found in frankincense extracts at a ratio of 40 – 60%. However, it is not found in *any* commercially produced essential oil.


3D model of α-boswellic acid

Therefore, should frankincense essential oil simply be considered benign? After all, using frankincense essential oil for cancer is not going to actually hurt anything is it? It depends. The answer may not be what you would think.

One way of thinking might be that it is valuable time wasted to use a remedial on a one who has cancer that cannot possibly have the effect one had hoped. Yet this next consideration may be surprising.

In the instance that a client is undergoing chemotherapy Robert Tisserand (leading scientist in the essential oil industry) states "Moderate amounts of EO will not kill cancer cells, but could protect them. And taking large amounts of essential oil could very well interfere with the chemotherapy itself, by increasing or decreasing the concentration of the drug-metabolizing enzymes in the liver. By causing a chemo drug to be metabolized more quickly you reduce the duration of its effect. On the other hand, if you inhibit its metabolism you reduce the efficacy of the drug. Neither of these is desirable, and chemo drugs are very carefully dosed for each patient."[209]

Turmeric is considered a complementary and alternative therapy for cancer because of its ability to induce apoptosis, however, its active constituent, curcumin (*Curcuma longa*) is again not found in its essential oil. While there are essential oils with anti-tumor and/or anti-cancer benefits, they are not always the most researched or unfortunately, the most publicized.

I (the author) found this out when I formulated a salve using ground cayenne and turmeric for sore arthritic joints and shingles. The complaint with the remedy was that turmeric stains making it difficult to get client compliance. While making the next batch I chose to substitute turmeric essential oil. I thought I would get the benefit of turmeric without the staining properties. The final result was an ineffective product that did not stain. Knowledge is crucial. How appropriate is this old German proverb: "Too soon we grow old, and too late we grow smart."

Volumes have been written about the wonders of essential oils therefore the brief description mentioned here will not offer the necessary knowledge the health professional needs to utilize them sufficiently. Be encourage to seek out the healing benefits of these amazing volatile oils.

Huperzine A (HupA)

Huperzine A is an alkaloid extracted from the club moss (*Huperzia serrata)* (Qian Ceng Ta). It is used in Traditional Chinese Medicine for fever, inflammation, bruises and swelling, rheumatism, colds, to increase circulation and to relax muscles and tendons, for schizophrenia, and the autoimmune disease myasthenia gravis. [210]

HupA has neuroprotective properties used to prevent epileptic seizures and nervous system dysfunctions caused by organophasphates (found in insecticides and herbicides) and nerve gasses. As an NMDA receptor antagonist, Huperzine A can help to prevent neurons from cell death due to glutamate toxicity. It can also protect against the oxidative damage that occurs from excessive iron.

As a nootropic HupA supports focus and cognition as well as those cognitive symptoms that result from depression (but not depression itself), and to enhance memory and learning capabilities. It may be used as a preventative and to reduce the symptoms of Alzheimer's. "Huperzine A works in similar ways to Alzheimer's drugs, including donepezil, rivastigmine, tacrine, and galantamine**,** although with fewer side effects and somewhat more favorable pharmacokinetics"[211]

According to one study, HupA may protect the brain from bacterial infections such as sepsis as it is anti-inflammatory and has been found to increase the functions of cholinergic neurons.[212]

As a recovery aid, HupA delays cell death and prevents dramatic mitochondrial damage due to brain hemorrhage and ensuing swelling.[213] "Huperzine A, together with other brain-supporting substances (vinpocetine, acetyl-L-carnitine, n-acetylcysteine, and alpha lipoic acid), multivitamin and fish oil, seems to help increase brain blood flow and improve cognitive functions in retired NFL football players with a history of concussions."[212]

Indole-3-Carbinol (I3C) (Also see DIM / 3,3'-diindolylmethane.)

Indole-3-carbinol is a phytochemical found in cruciferous vegetables such as broccoli and cabbage which shows great promise in its antioxidant ability to protect against certain cancers (especially those hormone-related cancers such as breast and prostate), environmental toxins (such as bisphenol-A/BPA), and even against harmful effects from radiation.

I-3-C is available in supplement form and also as DIM (3,3'-diindolylmethane) a metabolite of I-3-C that the body can also convert to similar beneficial effect. I-3-C/DIM may be useful for the moderation of estrogen metabolism as it is also antioxidant and antiatherogenic.

Indole-3-Carbinol (I3C) can be used for a range of health issues for its anti-inflammatory, anti-cancer, and anti-oxidant benefits. It is converted into Diindolylmethane (DIM) in the gut which boosts the immune system and may play a role in the prevention and treatment of certain cancers.

"Importantly, DIM has been shown to balance 4-hydroxyestrone, an estrogen that can have damaging effects and plays a role in reproductive cancers. In one study, supplementation with I3C at dosages of 200 and 400 milligrams per day for three months reversed early-stage cervical cancer in 8 of 17 women."[214]

Inositol

Inositol, once labeled vitamin B-8 appears to share many functions similar to choline. It is balancing to certain chemicals in the body, modulates many enzymes along with ATP, and plays a role in the metabolism of calcium and magnesium. "In healthy people, more inositol is in the body than vitamin B-3."[215] It is produced in the body, but is suppressed by the "Standard American Diet". It has been found that inositol deficiency is a contributing factor in metabolic disease and also that the high sugar, fat, and low fiber diet has a reduced availability of inositol causing metabolic deregulation.[216] Additionally, consuming excessive amounts of caffeine may cause inositol deficiency.

The lipotropic effect of inositol is beneficial in removing fat from the liver. Its anti-diabetic effects include the ability to increase insulin sensitivity thereby balancing hormones to better manage polycystic ovary syndrome (PCOS). A study on carp found myo-inositol deficiency to be associated with decreased intestinal immune function.[217] Another study found a links between inositol deficiency and insulin resistance and muscle control in those with Diabetes II, [218] and PCOS.[219] Inositol is required for healthy hair growth.

Called *myo*-Inositol, the "plant source inositol known as phytate 'has a strong chelating power for doubly charged metal ions', and is also a 'putative antiproliferative agent and may have some antioxidant activity.' Thus, inositol in Saccharomyces cerevisiae is preferred by some for its chelating abilities."[220]

Food sources of inositol are: nutritional yeast, fruits, lecithin, legumes, sesame seeds, wheat bran, whole grains, meats, milk, unrefined molasses, raisins, and vegetables.

Inositol May Improve

- ADHD
- Alzheimer's Disease
- Anger
- Arteriosclerosis
- Brain Function
- Cancer
- Constipation
- Depression
- Diabetes
- Diabetic Neuropathy
- Failure to Ovulate
- Hair Loss
- High Blood Pressure
- High Triglyceride Levels
- High Testosterone
- Insomnia
- Irritability
- Liver Disorders
- Mood Swings
- Muscle Function
- Nerve Function
- Obsessive-Compulsive Disorders
- Panic Disorder
- Perfectionism
- Schizophrenia
- Skin Eruptions

~ Methyl Donors

Methyl donors support the process of methylation. (See the description of methylation under S-adenosylmethionine (SAMe). They are helpful for the production of chemicals in the brain that affect mood, focus, concentration, and even the ability to see clearly. Some people may even notice improved energy and alertness as well as sexual enhancement.[221]

"Methyl donors are very interesting nutrients with a great deal of potential, particularly as antidepressants. Since our body's ability to methylate declines with age, it's possible that they may someday be found to have anti-aging benefits (Cooney, 1993). These nutrients can also be taken on days when one needs to be more focused and alert.

In addition to their effects on the mind, methyl donors, along with B vitamins, can help lower homocysteine levels, thus reducing the risk for certain heart and neurological diseases."[221] Increased homocysteine levels may indicate coronary artery disease and a need for methyl donors. Even moderate alcohol consumption hinders the body's absorption of methylated nutrients.

Methyl donors: Folate, Vitamin B6, Vitamin B12, Methionine, Choline, Inositol, DMG, DMAE, and SAMe. Zinc and magnesium support the methylation process.

Food sources of methyl donors are beets, garlic, and onions.

Oil of Oregano

Oregano oil (*Origanum vulgare*) is an herbal powerhouse of an essential oil. The key constituents from a batch of Hungarian *Origanum vulgare,* are carfacrol, cymene, terpinine, thymol, linalool, pinene, myrcene, caryophyllene + methyl carvacrol ether, and terpinine. This oil is anti-bacterial,

anti-diabetic, anti-fungal, anti-inflammatory, anti-microbial, anti-oxidant, anti-parasitic, anti-viral, and cancer-suppressing.

This essential oil is commonly used for achy joints, acne, allergies, arthritis, athlete's foot, asthma, bloating, bronchitis, candida, canker sores, cold and flu, croup, dandruff, earaches, fatigue, gastroenteritis, gum disease, headaches, heart conditions, heartburn, insect bites, insect repellant, menstrual cramps, muscle pain, oily skin, parasites, respiratory tract infections, rheumatoid arthritis, ringworm, rosacea, sinus pain, spider bites, swine flu, toothaches, urinary tract disorders and infections (UTIs), varicose veins, and warts.

Oregano is a considered a "hot" oil and its use should be approached with care. A maximum dilution of 1% (no more than 3 drops total in a 10ml roller) is recommended for topical applications.

Combines well with: Blue Tansy, Cajeput, Citronella, Dill Weed, Eucalyptus, Lemon, Geranium, Sweet Marjoram, Niaouli, Pine Scots, Roman Chamomile, Rosemary, and Thyme.

Contraindications: Short-term use only. Studies suggest that regular consumption of oregano essential oil may reduce the ability of the body to absorb iron. Do not use during pregnancy and lactation. Can be irritating to skin including mucous membranes. May interfere with antiplatelet, anticholinergic, anticoagulant, blood pressure, cholinergic, and diabetic medications. May also interact with aspirin or enhance the effects of antibiotics. Always used well-diluted.

Sulforaphane

Sulforaphane is organic sulfur, a chemical found in certain kinds of vegetables such as broccoli, cabbage, and cauliflower. Sulforaphane is used for the prevention of prostate and breast cancers and ...

"Studies have shown sulforaphane supports normal cell function and division while causing apoptosis (programmed cell death) in colon, liver, prostate, breast and tobacco-induced lung cancer. Just three servings of broccoli per week may reduce a man's risk of prostate cancer by more than 60 percent. Sulforaphane may also be helpful in the treatment of breast cancer. When tested in mice and cell cultures, sulforaphane was found to actually target and kill cancer stem cells, thereby preventing the formation and spread of tumors."[222]

Researchers at the Linus Pauling Institute recently conducted a study to determine if sulforaphane supplementation "would be well tolerated and might alter some of the epigenetic mechanisms involved in cancer," said Dr. Emily Ho, the principal investigator in this study from the LPI and also in the College of Public Health and Human Sciences at OSU.

This research was done with 54 women with abnormal mammograms who were scheduled for a breast biopsy and were studied in a double-blind, randomized, placebo-controlled trial. They received either a placebo or supplements that provided sulforaphane. The amount of sulforaphane they received would equate to about one cup of broccoli sprouts per day, if eaten as a food.

"We were surprised to see a decrease in markers of cell growth, which means these compounds may help slow cancer cell growth," said Ho. "This is very encouraging. Dietary approaches have traditionally been thought to be limited to cancer prevention, but this demonstrated it could help slow the growth of existing tumors."[223]

Sulphur / MethylSulfonylMethane (MSM)

"Nearly all disease can be traced to a mineral deficiency."
~ Linus Pauling, Nobel Laureate

Sulphur along with carbon, hydrogen, nitrogen, oxygen, and phosphorus is one of the six building blocks of life. The structural role of the mineral sulfur in amino acid and protein metabolism is important as it is part of the amino acid cysteine, taurine, glutathione, and methionine. It transports oxygen to the cells, is anti-aging, stimulates the secretion of bile, protects against radiation and environmental toxins. As a part of every cell in the body, Sulphur is necessary for the building of collagen and rebuilding of connective tissues such as tendons and cartilage as well as the skin, hair, and nails. Sulfur is also important in glutathione (a forefront antioxidant) synthesis as well as taurine synthesis which makes it essential for cardiovascular, joint, and liver health.

When produced commercially Sulphur is called Methylsulfonylmethane or more commonly MSM. "Sourced from the lignans of the Louisiana maritime pine tree, Organic Sulphur is an unadulterated form of MSM that comes out of the precipitator as odorless, white crystals. Commercial manufacturers typically crush their Sulphur crystals into a powder to expedite packaging and production. This common procedure reduces MSM's potency by as much as 85%."[224]

In an essay on sulfur deficiency found on the website for the Weston A. Price Foundation, Stephanie Seneff, Ph.D., asserts: "Sulphur/MSM may benefit disease states such as Alzheimer's, cancer, Crohn's, myasthenia gravis, and Parkinson's." The Oregon University of Health Sciences (OHSU)

It is important to remember that food sources of MSM have both macro and micro nutrients that are not available in supplements. "The isothiocyanate sulforaphane is formed when you chop or chew broccoli, as this combines its precursor glucoraphanin with the enzyme myrosinase. Once swallowed, gut bacteria help release some of broccoli's sulforaphane so your body can benefit, but it's a tricky proposition because sulforaphane is attached to a sugar molecule with a sulfur bond.

In order for the sulforaphane to be released, an enzyme in the broccoli breaks off the sugar to release it. However, the sulforaphane can be easily inactivated by a sulfur-grabbing protein. Researchers have found one of the best ways to maximize sulforaphane your body can use is to steam it lightly for three to four minutes until it's tough-tender. This is just enough heat to kill the epithiospecifier protein, which attaches to the sulfur and greatly depletes the amount of bioavailable sulforaphane. Do not steam longer than five minutes. If you opt for boiling, blanch the broccoli in boiling water for no more than 20 to 30 seconds, then immerse it in cold water to stop the cooking process. Another option is to eat broccoli sprouts. Fresh broccoli sprouts are FAR more potent than whole broccoli, allowing you to eat far less in terms of quantity. Tests have revealed that 3-day-old broccoli sprouts consistently contain anywhere from 10 to 100 times the amount of glucoraphanin — the precursor to sulforaphane — found in mature broccoli."[225]

Food sources of sulfur include beef, chicken, fish, eggs, and cheese. Vegetable sources include asparagus, beans (dried), bean sprouts, bok choy, broccoli, Brussels sprouts, cabbage, cauliflower, chives, collard greens, daikon garlic, green beans, horseradish, jicama, kale, leeks, mushrooms, onions, peas, radishes/radish greens, rutabaga sauerkraut (uncooked), scallions,

shallots, spinach, tempeh, turnips/turnip greens and wheat germ. Horsetail (*Equisetum arvense*) is an herbal source of Sulphur.

Contraindications: Individuals that are sensitive to sulphites potentially could react to either MSM or DMSO. Molybdenum deficiency may be causative of food sulphite allergies; therefore, adequate supplementation may reverse the condition. It is also possible that MSM may cause short-term discomfort due to its ability to cleanse the body. Symptoms such as nausea, diarrhea, weakness, or headaches may result from beginning with too high of a dose. It is best to begin slowly and build up to the desired maintenance dose to avoid these side-effects.

PREBIOTICS & PROBIOTICS

Prebiotics

Prebiotics are not bacteria, rather they are a nourishing part of foods that are non-living, non-digestible, and that ferment when they get to the large colon. During this process of fermentation, the beneficial bacterial colonies that reside there are "fed" and increase which reduces disease risk and promotes health.

An "Oxford study has even shown that it in humans, prebiotics have significant neurological benefits. They reduce stress and decrease anxiety and stress."[226] They also cause the multiplication of beneficial bacteria already living in the gut. In addition to good health maintenance, prebiotics are beneficial for those with digestive disorders and inflammatory bowel disease.

Food Sources: Onions, leeks, garlic, Jerusalem artichoke, asparagus, Jicama root, carrots, apples (the skin), apple cider vinegar (ACV), chicory root, burdock root, dandelion greens, seaweed, spinach, flaxseeds, wheat bran, beans, barley, Psyllium (see FIBER), oats, and honey.

Probiotics

Probiotics are live microorganisms such as bacteria or yeast that thrive in fermented foods. They are helpful to aid digestion and as remedials for diarrhea and irritable bowel syndrome, certain types of intestinal infections, and to prevent or support recovery of the common cold or the flu.

There is an average of 2,000 species of gut bacteria that make their home in the human gut. This would make 30-400 trillion resident bacteria depending upon the person.[227] In fact, microorganisms outnumber actual human cells in the human body by about 10 to 1. Yet they are very tiny and all together weigh somewhere between two to six pounds in the typical adult.

Healthy gut bacteria are important for maintaining immunity as they enhance the immune system and are a physical barrier to invading microbes. They are necessary for the body to properly integrate vitamins B and K as well as the minerals calcium and iron. Probiotic bacteria also help digest food. Restoring proper gut bacteria is a necessary first step in treating obesity, immunity, inflammation, certain mental disorders, ADHD, and autism.

Food Sources: Yogurt, coconut water kefir, kombucha, aged raw cheese, fermented pickles, sauerkraut, kimchi, and miso.

It is important to select supplements that contain multiple species of probiotic bacteria. Additionally, one can change brands (species) once a bottle is finished to incorporate more diversity into the existing gut bacteria.

SUGARS

D-mannose

D-mannose is a naturally-occurring sugar found in a number of fruits and vegetables that is closely related to glucose.

Mannose has an antibacterial action and can be helpful for treating urinary tract infections (UTIs). UTIs often affect the kidneys, urethra, and the bladder (which is frequently called cystitis). It is also a prebiotic useful for stimulating the growth of the beneficial bacteria found in the gut, therefore, it may be useful for bringing the gut back into balance.

"Up to half of all women will have some experience with a urinary tract infection. The main culprit in these infections is Escherichia coli (E.coli). This is the bacteria responsible for about 90% of all UTIs. E.coli is a normal bacteria found in the gastrointestinal system but it does not belong in the urinary tract. Overgrowth of E.coli in the urinary system will lead to an infection. D-mannose specifically rids the body of E.coli. The results of a Pub Med study done at NIH indicate that D-mannose can significantly reduce bacteria in the urine within one day of use. If you are suffering from a UTI D-mannose can effectively be used as a natural antibiotic against E.coli."[228]

Food Sources: black or red currants, blueberries, oranges, apples, cranberries (and cranberry juice), gooseberries, peaches, mangos, tomatoes, aloe vera, cayenne, fenugreek, kidney beans, lima beans, seaweed, and palm kernel oil. Additionally, mannose is found in locus bean, and in "guar gum and carob plant, mannose is in the form of galactomannan, which are polymers of mannose and galactose."[229]

Contraindications: Because D-mannose is a sugar, it is necessary for those with diabetes to exercise caution when supplementing with D-mannose. There is not enough known about the safety of D-Mannose, therefore, supplementation is not recommended for children, or during pregnancy and breastfeeding.

Xylitol

Natural xylose is obtained from birch tree bark as well as some fruits like strawberries or vegetables such as cauliflower. Manufacturers synthesize xylose into xylitol (a crystalline alcohol derived from xylose) from grains and birch trees. The end product is xylitol, a "sugar" that is indigestible with side-effects such as constipation or diarrhea or increased bowel movements, gas and bloating, stomach rumbling noises, nausea, and colic in babies.

In 1953, The Journal of Nutrition published an article on a study of the ingestion of xylose in rats. The toxic side-effects were the same as that in humans: diarrhea, boating and changes in the liver that suggested xylitol storage in the body. The scientists recommended that "Pending more favorable experimental data at lower levels of intake, it is deemed inadvisable to risk the incorporation of xylose in foods at any level of intake for extended periods of time."[230]

It has the appearance and taste of sugar, but has 40% less calories and is low (rates a 13) on the glycemic index and does not spike blood sugars. Therefore, in moderation it may be beneficial for diabetics and for weight loss. As xylitol cannot be digested by the bacteria in the mouth and is preferred for oral care by dentists.

Warning: Xylitol is extremely toxic for dogs.

TERRA FIRMA

Activated Charcoal

Charcoal has a unique ability to “adsorb” which means to gather a condensed layer of a dissolved substance, liquid, or gas upon its surface. The surface area of a mere teaspoon of activated charcoal equals that of an entire football field. Herein lies its power. Used for centuries both internally and externally (poultice), activated charcoal can be used as a general detoxifier, in cases of acute poisoning/overdose, topically as a poultice over an organ or wound.

Charcoal is not metabolized by the body. It can be constipating, when the individual is not sufficiently hydrated. Therefore, increased water intake should be considered when ingesting charcoal.

“Powdered charcoal reaches its maximum rate of adsorption in the stomach within one minute. So in the case of poisoning, the sooner it is given the better the chances of a successful treatment. The dose can be repeated every four hours, or until charcoal appears in the stool.”

Take one hour before or two hours after medication.

Oral - 30 grams (approx. 3 TBSPS) activated charcoal plus 4 ounces water, drink 8 oz glass of water. If vomited, repeat the dose. The third time charcoal is taken it usually stays down.

Topical – mix Activated charcoal with ground flaxseed to retain moisture when using as a poultice.

Colloidal Silver

Prior to refrigeration it was common practice to place a silver coin in the milk jug to keep the milk fresh longer. As a medicinal, colloidal silver was even used by the Greek and Roman physicians of old to treat infections.

As an anti-inflammatory, antibacterial, and antimicrobial destroyer of both aerobic and anaerobic disease-causing pathogens, colloidal silver does not create resistance or immunity by the organisms it affects. It is very useful as a topical agent to the skin for use in treating burns, eczema, ear infections, periodontitis, pink eye, psoriasis, ringworm, and wounds. In fact, the one of the best uses of silver is topical as a throat spray.

Silver’s antiviral actions support herpes, shingles, warts, pneumonia, and HIV/AIDS. Colloidal Silver also acts as an antibiotic in that it also kills off beneficial gut microflora. As a result, it is necessary to supplement with probiotics both during treatment and for a period of time after use. Silver is not meant to be ingested in large doses or for long periods of time.

There is no use for colloidal silver by the body. Therefore, the body quickly attaches various molecules to the silver to eliminate it through the bowels or the kidneys. Colloidal silver ions quickly attach to chloride (and other molecules) in our body fluids and become inactive. It appears that colloidal silver has low toxicity and up to 99 percent is eliminated from the body.

Sharlene Peterson, President of Genesis School of Natural Health, asks her natural health students, “Why would I use silver internally when it is known to tie up resources in an already weakened body, when antibacterial herbs are equally as effective and they rebuild and support the body systemically?”

It is important to not confuse colloidal silver with ‘ionic’ or ‘nano’ silver products. Most people don’t understand that ionic silver is frequently sold as “colloidal silver”, but they are actually very different.

“Colloidal silver is simply water with small nanoparticles of metallic silver in it. The silver particles are complete and do not combine with other elements. The same cannot be said for ionic silver. If you’re more scientifically savvy than the average person, you’ve probably already guessed that ionic silver is an atom of silver that is missing an electron. The outermost electrons of an atom determine the physical properties of the matter. When one electron is taken away from a silver atom and you are left with a silver ion. Ionic silver is not the same as metallic silver, silver particles or colloidal silver.

Additionally, when that one electron is missing meaning the silver is in its ionic form, it is highly reactive with other elements, and will readily combine to form compounds. Pure silver particles, on the other hand, are made up of clusters of silver atoms and do not combine with other atoms of other elements, as their electron count is already “full.”[231]

Therefore, nano (or “ionic”) silver should be considered differently than the much larger colloidal silver molecules. One research paper that was published in ACS Nano , research paper, published in the February 2014 issue of *ACS Nano*, “studied the effects of nanosilver on human intestinal cells. Researchers found that exposure to nanosilver did damage to the cells’ DNA and temporarily changed their protein production.”[232] This study did clarify that that the smaller 20 nm silver particles were found more likely to enter the cells than even the larger 100 nm molecules. Another newly released study has found that nano silver has the potential to prime mast cells to react in an allergic manner.[233] Because the research with silver is incomplete, antibacterial herbs and homeopathics are preferable, especially for internal use. When using silver products, colloidal is always preferable to nano. Do not be swayed by the marketing hype. If nano/ionic silver is entering the cells, it is causing harm that is not fully understood and not exiting the body in the same manner as colloidal silver.

Contraindications: There is a very real consequence of not using this product in moderation and for a specific purpose. Particles that are not ionized (and there will be some in the colloidal silver), do not circulate in the body and can build up over time in the skin and cause argyria (blue skin.) Not recommended for pregnant or lactating women. There are no adverse drug or herbal interactions.

Montmorillonite / (Calcium) Bentonite Clay

Bentonite clay is volcanic ash that has accumulated high amounts of minerals from sea water. It is used to detox, cleanse skin and hair, and also support digestive function. Applications where Bentonite clay may be useful include: balancing the gut microbiome, food poisoning, skin infections, stomach ulcers, antibiotic-resistant infections, gut bacterial infections of other tissues, plague, viral conditions, cancer (liver, brain, Leukemia, colon, breast), preventing waste buildup due to kidney damage.

The author of Earth Cures, Raymond Dextreit, describes Bentonite clay as “incomparable for maintaining or reestablishing a good normal flora, for it favors the development of useful ferments, while opposing the growth of pathogenic bacilli.”

While as a colon cleanser, clay pulls “out old putrefied fecal matter and mucoid plaque buildup that is blocking the absorption of vitamins, minerals, supplements and nutrition from the foods we eat. Energy levels are known to increase in 1-3 days depending on the state of the individual.”[234]

With a relatively high absorbency, Bentonite clay can remove fat and toxins from the skin and is a good cleanser for oily skin. It has also found effective for those with poison ivy/oak and has also reduced symptoms of eczema, and increased wound healing. It may be considered for acne due to its adsorption of fat and ability to destroy infectious bacteria.[235]

Bentonite clay can be helpful for curbing diarrhea (whether bacterial or viral in cause), nausea, stomach pain, and lack of appetite, due to the large surface area of its main component, montmorillonite. In one study, “The standard treatment employees was 2 tablespoonfuls of bentonite in distilled water as a vehicle 3 times daily. In cases of food allergy, the dosage was increased above 6 tablespoonfuls daily.”[236]

In a study with 28 children, Bentonite clay was found significantly protective in the disease Henoch-Schonlein purpura, where blood vessels are inflamed causing destruction the mucosal barrier of the abdominal GI tract.[237]

Another study was done that compared the ability of bentonite clay and calendula to improve infant diaper rash. It was found that the bentonite cream began working faster and resolved lesions quicker than calendula cream.[238] One can easily make and apply a thin paste using water, being sure to reapply as needed. Bentonite clay can also be used as an alternative for baby powder. Use sparingly.

As an effective binder for toxins Bentonite clay enhances the body’s detox mechanism. “With a strong negative charge, bentonite clay attracts bacteria, pesticides, pathogens and heavy metals, flushing them out of your gut. As these are eliminated from the body, it may help to heal irritable bowel syndrome and leaky gut syndrome, which will allow your gut's good bacteria to flourish.”[239] Scientific studies have found Bentonite clay able to adsorb mold toxins; microorganisms; pesticides such as paraquat and organophosphates; heavy metals; and excess fluoride in water…”[240]

“Bentonite clay has a high absorption rate and a unique chemical structure with surface particles both negatively and positively charged. Interestingly, the clay can carry particles three to four times its size and hold them as they travel outside the body.”[239]

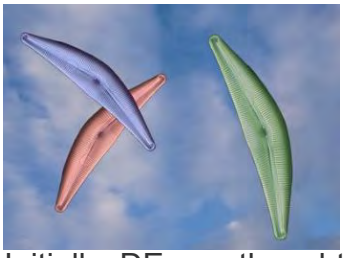
Sodium and calcium are the two main types of Bentonite clay. Sodium bentonite, most frequently used for industrial applications, should never be used internally. Industrial-grade bentonite is also very high in crystalline silica which is ab inhalation danger as the dry powder can cause problems in the lungs. Internal use should be restricted to Calcium bentonite. (Montmorillonite is a calcium bentonite clay from Montmorillonite France, hence the name.) When selecting a clay product, one’s primary consideration should be to select a food-grade product with a high calcium content and free of toxic contaminants.

Contraindications: Bentonite clay is a potent binder and may actively prevent the transport of certain drugs into the bloodstream. These are drugs commonly prescribed for conditions such as: allergies, diabetes, heart disease, psychiatric disorders, and respiratory diseases, as well as conditions requiring antibiotics, sedatives, and stimulants.

Bentonite should not be considered an adequate mineral supplement. Although bentonite clay does contain minerals, they are bound within a clay particle that does not break down during digestion. Also, it should not be ingested in large quantities. Too much may cause disruption with the absorption of vital nutrients and proper digestion.

While most Bentonite clay from reputable sources is fine, some has been found with unsafe levels of lead in skin care products. Confirm that the bentonite clay you intend to use is food grade.

Diatomaceous Earth



Made up of about 85 percent silica, Diatomaceous Earth (DE) originates from fossilized diatoms which are unicellular aquatic organisms. Their exoskeletons were made of up silica. Its pesticidal qualities come from its ability to adhere to insects and cut fissures through their skin/exoskeleton and dehydrate them. Food grade DE is safe to use in gardens, on crops, and around people and pets.

Initially, DE was thought to work by the sharp microscopic edges of the silica crystals scraping through the exoskeleton of insects causing them to dehydrate and die. It is now thought that the diatoms "are extremely porous, enabling them to absorb any moisture that crosses their path. Insects fall prey to these tiny cylindrical looking shells due to their ability to absorb the waxy coating that protects the insect from the loss of moisture."[241] Both means of pest control are mechanical, however, current opinion highlights DE's absorptive abilities.

Many articles state that the antiparasitic properties of DE are unfounded. However, there are quite a number of scientific animal studies that clearly reveal DE-lowered parasite loads in the DE groups when compared with conventionally-treated groups and control groups. While pharmaceutical therapies are more immediate-acting, after about six weeks of daily DE use the results were equally as impressive in DE-supplemented cattle. "Egg counts for CTRL and DE groups decreased in March and none of the groups differed (P > 0·05) significantly for the remainder of the study."[242]

Here's another: "Two studies were carried out to assess the efficacy of diatomaceous earth as an alternative to anthelmintics in grazing ruminants. Animals treated with anthelmintics and groups of untreated animals were included for comparison. Cattle and sheep which received the diatomaceous earth supplement had low Faecal Egg Counts (FEC) for the duration of the experimental period, similar to animals in the anthelmintic groups. Inclusion of diatomaceous earth in the diet of grazing ruminants may offer some benefits in controlling internal parasites."[243]

The author of 'Gut and Psychology Syndrome', Doctor Natasha Campbell-McBride M.D., suggests using natural supplements such as diatomaceous earth for to help remove toxins from the body.[244] However, for most people, simply reducing inflammation will clear the skin, lift mood, and reduce health problems – all effects people hope to gain through a "detox".

As water is mixed with DE a very strong negative charge is created. This is what draws (like a powerful magnet) in positively-charged molecules such as toxins and heavy metals.[245] Dr. Eric Berg, DC, states that DE is great to take concurrently while performing liver or kidney cleanses as it helps to clean up any released toxins.[246]

Always take DE on an empty stomach; away from food, supplements, and drugs. It is best to start with a small daily dose of 1 teaspoon mixed with water in either a glass or plastic container. Use a non-metallic spoon to stir or a plastic lid to shake if you choose a jar. Always follow with lots of water as hydration is very important with any detox and DE can be mildly constipating.

It is common practice to detox for 90 days (10 days on, then 10 days off, and repeat). If you have symptoms such as headache, fatigue, or low energy take a break for a few days and start in again at half the dose and build up slowly. If there is stomach or intestinal pain, discontinue use.

Contraindications: Those with severe digestive conditions such as Crohn's and Ulcerative Colitis should not consume DE. Do not give to infants or pregnant/lactating women. Do not overconsume (more than one tablespoon at a time.) Be sure to drink extra water as DE is very absorbent. Do not ingest long-term.

While DE is non-toxic, it is drying to the skin, so it is advised to handle with gloves or wash off immediately after use. Avoid inhalation as the powder may cause lung irritation and damage. Amorphous silica which is of low toxicity. DE does contain very little crystalline silica. To be considered food-grade it must contain less than 1 percent. Use only select food grade/codex grade DE for internal use.

Fulvic Acid

Fulvic Acid is a term used to reference a grouping of natural humic acids found in soil that are comprised of many ionic trace mineral bonds. These bonds tend to change their structure depending upon the element to which they are exposed. Due to the complexity of the molecular forms, scientists have not been able to synthesize Fulvic Acids.

Fulvic Acids are important because they optimize the transporting of nutrition past the immune system and through cellular membranes. “One molecule of fulvic acid is capable of holding up to 60 other ionic particles or trace minerals!”[247] It is also a primary active component of Shilajit.

The health-promoting benefits of fulvic acid may include: improving gut health and metabolism, assisting in removing pollutants and toxins from the body, reducing inflammation, speeding up recovery time, improve skin conditions, prevent growth and spread of tumors[d], boosts mitochondrial energy, increases longevity, slow the progression of Alzheimer’s disease by shortening the length of and by disassembling neurofibrillary tangles.[248]

“There is some evidence that consuming fulvic acid can help decrease digestive disorders and other issues, including: SIBO symptoms (small intestine bacterial overgrowth), inflammatory bowel disorders, bacterial infections (respiratory, urinary tract, etc.), or the flu and common colds, for example.”[249]

Caution: Fulvic Acid can promote side effects such as nausea, dizziness, increased heart rate, and itchiness. These are detoxification reactions and only noticeable when taken in large amounts.

Chronic use can cause Vitamin B3 deficiency, therefore it is wise to take breaks when supplementing Fulvic Acid alone.

Contraindications: It is wise to leave a 2-hour gap between taking pharmaceuticals, alcohol, or herbs such as licorice root or strong herbal teas.

Shilajit

Prized by Ayurvedic practitioners for its ability to undergird the body with nutrition and energy, shilajit, a mineral pitch, has the ability to restore energy, increase fertility, enhance immunity, and safeguard memory against the effects of aging.[250]

Shilajit is organic plant material of brown to blackish-brown exudation found pressed in between rocks in the Himalayas, Russia, Tibet, and Norway at altitudes of 1,000 to 5,000 meters. This immense amount of pressure breaks down the mineral and trace minerals (at least 85) found in shilajit into a highly bioavailable ionic form.

Shilajit functions as an herbal adaptogen. "Studies show that shilajit administration boosts ATP production, reduces mitochondrial damage, and protects heart and brain from age-associated energy loss."[250] The results of another interesting study reveal that "Shilajit has inhibitory effects on the SG neurons of Vc through chloride ion channels by activation of the glycine receptor and GABA(A) receptor, indicating that Shilajit contains sedating ingredients for the central nervous system. These results also suggest that Shilajit may be a potential target for modulating orofacial pain processing."[251] The significance of Shilajit's sedation of the central nervous system (CNS) may be helpful in movement disorders and seizures, instances where there is too little of the neurotransmitter GABA.

"Modern research has validated these claims and has proven shilajit to be a panacea in oriental medicine."[252] It is unfortunate that adulterated shilajit is readily available. Purified, authentic shilajit is always a dark brownish-to-black, sticky, resinous material. It does not come in a powder. It is more commonly used as a rejuvenator in Russia and a reliable source is Russian Federation Mummiyo (pronounced: 'moo-mee-yo') Shilajit.

Typical doses are a pea-sized amount 1 to 3 times per day. It is not a particularly inviting taste on its own, but it "melts" in liquids such as almond milk or tea (not boiling hot) making it easier to consume. It provides a gentle lift in energy and can be taken in the evening without fear of disturbing sleep.

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About the Author

Darlene Jorgens is a graduate of the Genesis School of Natural Health. As a Holistic Health Professional and Clinical Master Herbalist, Darlene provides holistic health consultations to the community through her business, The Herbs & The Bees, LLC.

Her passion and creativity for helping people achieve their natural health goals is contagious. With a soft spot for animals, Darlene has successfully applied holistic principles and remedies in her work with horses and other pets. Her hobbies include music, gardening, herb walks, and trail rides.

Originally from upstate New York, Darlene has lived in the Pacific Northwest, the Southern U.S., and currently resides in the Cleveland, Ohio area with her husband Brian, two horses, and a spotted mini donkey named 'lil Baby.