QCS VITALS DETAIL SHEET

BLOOD

BLOOD LIPIDS

HDL-C
HDL Cholesterol is the measure of cholesterol carried in the particles called high density lipoproteins. HDL is known as the good cholesterol and a protective lipoprotein fraction, because the high density lipoproteins usually carry harmful cholesterol molecules away from the vessel walls back to the liver where they are metabolized. This healthy process is called reverse cholesterol transport. Optimally HDL levels should be above 40 for men and above 50 for women.

LDL-C Direct
Low density lipoprotein-cholesterol. Bad cholesterol that can build up in arteries and increase risk of heart disease and stroke.

Neutral Fat (MB)
A glycerol molecule bound to three fatty acids (triglyceride). They are neutral because they do not contain any basic or acidic groups. They are often found in the thigh and torso area of the body where they provide insulation to keep warm and provide body fuel reserves.

Non-HDL-C
Total Cholesterol minus HDL cholesterol.

Total Cholesterol
This represents the total amount of cholesterol circulating in the blood, including good (HDL-C) and bad (LDL-C) cholesterol.

Triglycerides
High levels in the blood this type of fat is unhealthy.

BLOOD-LIPO & APOLIPOPROTEINS

Apo-A-1
Apolipoprotein A-I, which is the major protein component of high density lipoprotein (HDL) in plasma. The encoded preproprotein is proteolytically processed to generate the mature protein, which promotes cholesterol efflux from tissues to the liver for excretion, and is a cofactor for lecithin cholesterol acyltransferase (LCAT), an enzyme responsible for the formation of most plasma cholesteryl esters.

Apo B
This represents a better measure of the lipoproteins in your blood that you need to keep in check. High levels can lead to plaque that causes heart disease. Apo B helps to unlock the doors to cells and carries cholesterol to them.

Apo B: Apo A-1 ration
The apo B/A-1 is a stronger predictor of cardiovascular events than LDL, HDL, or Total Cholesterol, Triglycerides, or Lipid Ratios. Individuals with seemingly normal LDL cholesterol (< 3.3 mmol/L, 127.1 mg/dL) may in fact have high apo B values, revealing the presence of many small, dense LDL particles, thus indicating substantial risk.

HDL-P
This represents the actual number of HDL (good) particles in the blood.

HDL2-C
Is associated with better health. Some studies have shown it to increase with exercise. One of the important functions of HDL is to transport cholesterol from the cells and tissue back to the liver. High HDL-cholesterol is good as it takes cholesterol out of cells and the blood and helps to prevent excess cholesterol. HDL also removes cholesterol deposited in the walls of blood vessels.

LDL-P
This (LDL particle number) measures the actual number of LDL particles (particle concentration, nmol/L). It appears that LDL-P may be a stronger predictor of cardiovascular events than LDL-C. Low LDL-P is a much stronger predictor of low risk than low LDL-C. In fact, about 30 – 40% of those with low LDL-C may have elevated LDL-P.
Source: http://www.ncbi.nlm.nih.gov/pubmed/19657464

Lp(a) Mass
It is the worst form of LDL and is an inherited trait that can increase risk of heart disease and stroke.

sdLDL-C
Small dense, low density lipoproteins are more likely to damage your artery wall as they can enter more easily than the larger particles.

BLOOD-OTHER

Albumin
It is a protein made by the liver that keeps fluid from leaking out of blood vessels, nourishes tissues, and transports hormones, vitamins, drugs, and substances like calcium throughout the body. An albumin test may be ordered as part of a liver panel to evaluate liver function or with creatinine, blood urea nitrogen (BUN), or renal panel to evaluate kidney function. Albumin may also be ordered to evaluate a person's nutritional status.

Circulating immune complex (CIC)
This evaluates the immune system, whose function is to defend the body against such invaders as bacteria and viruses. The immune system also plays a role in the control of cancer, and is responsible for the phenomena of allergy, hypersensitivity, and rejection problems when organs or tissue are transplanted. One of the ways the immune system protects the body is by producing proteins called antibodies. Antibodies are formed in response to another type of protein called an antigen (anything foreign or different from a natural body protein). Immune complex reactions occur when large numbers of antigen-antibody complexes accumulate in the body. Circulating immune complexes (CICs) are detectable in a variety of systemic disorders such as rheumatological, autoimmune, allergic diseases; viral, bacterial infections and malignancies.

Ferritin
This is a protein that binds iron and transports it through the bloodstream. Very high levels can indicate problems with your body's ability to store iron. Increased ferritin levels can also occur when insulin resistance and/or inflammation are present in the body, indicating increased risk for heart disease and diabetes.

Total Iron Binding Capacity (TIBD)
This is a medical laboratory test that measures the blood's capacity to bind iron with transferrin. TIBC is usually higher than normal when the body's iron supplies are low. This can occur with:

Iron deficiency anemia
Pregnancy (late)
Lower-than-normal TIBC may mean:
Anemia due to red blood cells being destroyed too quickly (hemolytic anemia)
Lower-than-normal level of protein in the blood (hypoproteinemia)
Inflammation

Liver disease, such as cirrhosis
Malnutrition
Decrease in red blood cells from the intestines not properly absorbing vitamin B12 (pernicious anemia)
Sickle cell anemia

Total Protein
This is a rough measure of all of the proteins in the plasma portion of your blood. Proteins are important building blocks of all cells and tissues; they are important for body growth and health. Total protein measures the combined amount of two classes of proteins, albumin and globulin.

CBC

Basophils
An increased percentage of basophils may be due to: after splenectomy, allergic reaction, chronic myelogenous leukemia, collagen vascular disease, myeloproliferative disease, or varicella infection. A decreased percentage of basophils may be due to: acute infection, cancer, or severe injury.

***It is important to realize that an abnormal increase in one type of white blood cell can cause a decrease in the percentage of other types of white blood cells.*

Eosinophils
An increased percentage of eosinophils may be due to: Addison disease, allergic reaction, cancer, chronic myelogenous leukemia, collagen vascular disease, hypereosinophilic syndromes, or parasitic infection.

***It is important to realize that an abnormal increase in one type of white blood cell can cause a decrease in the percentage of other types of white blood cells.*

Hematocrit
This measures the percentage of a person's total blood volume that consists of red blood cells.

Hemoglobin
This is an iron-rich protein in red blood cells that carries oxygen. The blood test measures the total amount of this oxygen-carrying protein in the blood, which generally reflects the number of red blood cells in the blood.

Immature Granulocytes
With the exception of blood from neonates or pregnant women, the appearance of immature granulocytes in the peripheral blood indicates an early-stage response to infection, inflammation

or other stimuli of the bone marrow. Being able to detect them quickly and reliably opens doors to new diagnostic possibilities for related disorders. Current areas of research regarding the diagnostic significance of circulating immature granulocytes focus on the early and rapid discrimination of bacterial from viral infections, particularly in children, recognizing bacterial infection in neonates, and the early recognition of bacterial infection and sepsis in adults, which is of vital importance in particular for intensive care patients.

Lymphocytes
Lymphocytes are a part of the white blood cells. They are made up of 'T' cells which remove foreign objects that are not supposed to be in the body and 'B' cells which are instrumental in the immune system. They produce antibodies when a suspicious foreign object is found in the blood. The other type of lymphocyte is the natural killer cell. They simply kill any object found in the cell that is considered to be abnormal such as tumor cells or infections. Lymphocytes are associated with infections and diseases. An elevation in the level of lymphocytes is considered to be a sign of a viral infection. An increased percentage of lymphocytes may be due to: chronic bacterial infection, infectious hepatitis, infectious mononucleosis, lymphocytic leukemia, multiple myeloma, viral infection (such as mumps or measles)

A decreased percentage of lymphocytes may be due to: chemotherapy, leukemia, radiation therapy or exposure, sepsis, steroid use and HIV which is a cause for extremely low levels of 'T' cells.

***It is important to realize that an abnormal increase in one type of white blood cell can cause a decrease in the percentage of other types of white blood cells.*

MCH
This (Mean corpuscular hemoglobin) is a calculation of the average amount of hemoglobin inside a single red blood cell.

MCHC
This (Mean corpuscular hemoglobin concentration) is a calculation of the average concentration of hemoglobin inside a single red blood cell.

MCV
This (Mean corpuscular volume) is a measurement of the average size of a single red blood cell.

Monocytes
Measures the number or percentage of monocytes, which are white blood cells that move out of the circulating blood and into the tissues, where they mature into macrophages. An increased percentage of monocytes may be due to: chronic inflammatory disease, leukemia, parasitic infection, tuberculosis, viral infection (for example, infectious mononucleosis, mumps, or measles.

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Neutrophil
Measures the number or percentage of neutrophils, which are normally the most abundant circulating white blood cells and respond quickly to infection. Any infection or acute stress increases your number of white blood cells. High white blood cell counts may be due to inflammation, an immune response,or blood diseases such as leukemia. An increased percentage of neutrophils may be due to: acute infection, acute stress, eclampsia, gout, myelocytic leukemia, rheumatoid arthritis, rheumatic fever, thyroiditis, or trauma.
A decreased percentage of neutrophils may be due to: aplastic anemia, chemotherapy, influenza (flu), radiation therapy or exposure, viral infection, or widespread severe bacterial infection.

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Platelets
A platelet count that's lower than normal (thrombocytopenia) or higher than normal (thrombocytosis) is often a sign of an underlying medical condition, or it may be a side effect from medication. If your platelet count is outside the normal range, you'll likely need additional tests to diagnose the cause.

RBC
A red blood cell count that's higher than normal (erythrocytosis), or high hemoglobin or hematocrit levels, could point to an underlying medical condition, such as polycythemia vera or heart disease.

RDW
Red cell distribution width is a parameter that measures variation in red blood cell size or red blood cell volume. RDW is elevated in accordance with variation in red cell size (anisocytosis), ie, when elevated RDW is reported on complete blood count, marked anisocytosis (increased variation in red cell size) is expected on peripheral blood smear review.

WBC
A low white blood cell count (leukopenia) may be caused by a medical condition, such as an autoimmune disorder that destroys white blood cells, bone marrow problems or cancer. Certain medications also can cause white blood cell counts to drop. If your white blood cell count is higher than normal, you may have an infection or inflammation. Or, it could indicate that you have an immune system disorder or a bone marrow disease. A high white blood cell count can also be a reaction to medication.

FATTY ACIDS, OMEGA-3

Fatty acids are the core building blocks of cellular membranes making them critical for cell membrane structure and function as well as local signaling. Essential fatty acids (EFAs) cannot be synthesized by the human body and must be obtained in the diet or through supplementation. EFAs are transformed into local hormonal mediators called eicosanoids, a process vital in the ability of the body's immune system to repair and protect itself and to regulate inflammation.

Evaluating essential and metabolic fatty acids can be helpful for patients with inflammatory disorders, cardiovascular issues, hormonal disorders, autoimmune disorders, arthridities, senile neurological degeneration, mental and behavioral disorders, attention deficit hyperactivity disorder (ADHD), insulin resistance and obesity, and hair and skin related conditions.

Alpha linolenic acid (ALA)
α-Linolenic acid is an n−3 fatty acid. It is one of two essential fatty acids, so called because they are necessary for health and cannot be produced within the human body. They must be acquired through diet. Alpha Linolenic acid is a kind of omega-3 fatty acid found in plants. It is found in flaxseed oil, and in canola, soy, perilla, and walnut oils. Alpha–linolenic acid is similar to the omega-3 fatty acids that are in fish oil, called eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).

ALA has an important role in reducing chronic disease through conversion to EPA and DHA, as well as through its own unique metabolic activities. Additionally, what many fail to understand is the critical need for both plant- and fish-based omega-3s, especially considering the increasing predominance of omega-6 fatty acids in the diet.
ALA is the true "essential" omega-3 fatty acid, because it is the parent fatty acid of the omega-3 family and must be obtained from foods. ALA consumption may reduce the risk of heart disease and other inflammatory diseases by reducing inflammatory compounds called cytokines and eicosanoids.

Docosahexaenoic acid (DHA)
This is essential for the growth and functional development of the brain in infants. DHA is also required for maintenance of normal brain function in adults. The inclusion of plentiful DHA in the diet improves learning ability, whereas deficiencies of DHA are associated with deficits in learning. DHA is taken up by the brain in preference to other fatty acids. The turnover of DHA in the brain is very fast, more so than is generally realized. DHA is present in fatty fish (salmon, tuna, mackerel) and mother's milk. DHA is present at low levels in meat and eggs, but is not usually present in infant formulas.

Fish oil decreases the proliferation of tumor cells, whereas arachidonic acid, a long chain n-6 fatty acid, increases their proliferation. These opposite effects are also seen with inflammation, particularly with rheumatoid arthritis, and with asthma. DHA has a positive effect on diseases

such as hypertension, arthritis, atherosclerosis, depression, adult-onset diabetes mellitus, myocardial infarction, thrombosis, and some cancers.

Epidemiological studies have shown a strong correlation between fish consumption and reduction in sudden death from myocardial infarction. The reduction is approximately 50% with 200 mg day(-1)of DHA from fish. DHA is the active component in fish. Not only does fish oil reduce triglycerides in the blood and decrease thrombosis, but it also prevents cardiac arrhythmias. The association of DHA deficiency with depression is the reason for the robust positive correlation between depression and myocardial infarction.

Docosapentaenoic acid (DPA)
This an elongated version of EPA, is starting to gain recognition in the scientific community for its role in improving human health, particularly in controlling inflammation. In order to get to know DPA, it is important to understand the unique benefits it can deliver that EPA and DHA cannot.

What is unique about DPA?

- DPA inhibits platelet aggregation more efficiently than EPA or DHA, meaning it hinders the formation potentially of deadly blood clots
- It is a precursor for oxylipins, anti-inflammatory and neuroprotective compounds
- DPA stimulates endothelial cell migration much more efficiently than EPA, meaning a stronger protection from atherosclerotic diseases such as coronary heart disease
- It is incorporated into phospholipids faster than EPA, meaning the fatty acids can cross the blood barrier and be utilized by the body more efficiently.

In a study conducted by the Institute of Public Health and Clinical Nutrition, University of Eastern Finland, blood levels of DPA, a marker for DPA consumption, had the strongest association with healthy C-reactive protein (CRP) levels in middle-aged men when compared to other omega-3s such as EPA and DHA. DPA has also shown to have a more direct biological role in the inhibition of cyclooxygenase, an enzyme that produces the prostaglandin hormones that sparks inflammation.

Eicosapentaenoic acid (EPA)
EPA is a polyunsaturated fatty acid (PUFA) that acts as a precursor for prostaglandin-3 (which inhibits platelet aggregation), thromboxane-3, and leukotriene-5 eicosanoids. It is obtained in the human diet by eating oily fish or fish oil, e.g. cod liver, herring, mackerel, salmon, menhaden and sardine, and various types of edible seaweed and phytoplankton. It is also found in human breast milk. The human body converts alpha-linolenic acid (ALA) to EPA. ALA is itself an essential fatty acid, an appropriate supply of which must be ensured.

The efficiency of the conversion of ALA to EPA, however, is much lower than the absorption of EPA from food containing it. Because EPA is also a precursor to docosahexaenoic acid (DHA), ensuring a sufficient level of EPA on a diet containing neither EPA nor DHA is harder both because of the extra metabolic work required to synthesize EPA and because of the use of EPA

to metabolize into DHA. Medical conditions like diabetes or certain allergies may significantly limit the human body's capacity for metabolization of EPA from ALA.

Getting more EPA in your diet has positive effects on coronary heart disease, high triglycerides (fats in the blood), high blood pressure, and inflammation. Omega 3's including EPA have shown positive benefits for depression, rheumatoid arthritis, menopause, mentstrual pain, Raynaud Syndrome, lupus, lung and kidney diseases, type 2 diabetes, obesity, ulcerative colitis, Crohn disease, anorexia nervosa, burns, osteoarthritis, osteoporosis, and early stages of colorectal cancer.

PRECAUTION: Fish oil capsules have both DHA and EPA. DO NOT give supplements with EPA to a child unless your pediatrician tells you to because they upset the healthy balance between DHA and EPA during early development.

HS-Omega-3 index (RBC EPA+DHA)a
The HS-Omega-3 Index is the EPA+DHA content of red blood cells (RBCs) expressed as a percent of total identified RBC fatty acids. It is measured using a proprietary methodology developed over several years of research. Although intake of omega-3 fatty acids is related to cardiovascular risk, EPA and DHA measurements can provide a more accurate prediction of clinical events. The sum of EPA and DHA, expressed as a percentage of total phospholipid fatty acids, is called the omega-3 index. The index can be used as an indicator of risk for sudden cardiac death and nonfatal cardiovascular events and as a therapeutic target. It can also be used to assess adherence to omega-3 therapy and/or success or failure of such therapy.

***Many fish sources are known to be toxic due to contaminated waters. Take care in finding sources from clean waters and not from fish farms. As a food look for wild caught varieties, and as a supplement make sure the source is pure and not rancid.*

FATTY ACIDS, OMEGA-6

Omega-6 fatty acids are precursors to endocannabinoids, lipoxins, and specific eicosanoids.Omega-6 fatty acids are essential fatty acids. They are necessary for human health, but the body cannot make them. You have to get them through food. Along with omega-3 fatty acids, omega-6 fatty acids play a crucial role in brain function, and normal growth and development. As a type of polyunsaturated fatty acid (PUFA), omega-6s help stimulate skin and hair growth, maintain bone health, regulate metabolism, and maintain the reproductive system.

Medical research on humans found a correlation (correlation does not imply causation) between the high intake of omega-6 fatty acids from vegetable oils and disease in humans. However, biochemistry research has concluded that air pollution, heavy metals, smoking, second-hand smoke, Lipopolysaccharides, lipid peroxidation products (found mainly in vegetable oils, roasted nuts and roasted oily seeds) and other exogenous toxins initiate the inflammatory response in the cells which leads to the expression of the COX-2 enzyme and subsequently to the

temporary production of inflammatory promoting prostaglandins from arachidonic acid for the purpose of alerting the immune system of the cell damage and eventually to the production of anti-inflammatory molecules (e.g. lipoxins & prostacyclin) during the resolution phase of inflammation, after the cell damage has been repaired.

Modern Western diets typically have ratios of omega-6 to omega-3 in excess of 10 to 1, some as high as 30 to 1; the average ratio of omega-6 to omega-3 in the Western diet is 15:1-16.7:1. Humans are thought to have evolved with a diet of a 1-to-1 ratio of omega-6 to omega-3 and the optimal ratio is thought to be 4 to 1 or lower, although some sources suggest ratios as low as 1:1.

Arachidonic acid (AA)
This is an omega-6 unsaturated fatty acid your body requires to function properly. The National Institutes of Health reports that this fatty acid can be made in the body if you consume adequate amounts of linoleic acid in your diet. In our diet, the most commonly consumed omega-6 fatty acid is Arachidonic Acid (AA) found in meats, eggs and dairy products. This particular omega-6 fatty acid is vital for muscle growth, brain development and maintaining a healthy nervous system; but our body does not require much of this omega active and when consumed in excess, it can promote inflammation. When we have an excess of AA in our body, it prevents LA from converting into GLA.

The ratio between the omega-6 arachidonic acid (AA) and the marine omega-3 essential fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) reflects mood related wellness. This Index should be below 1:1. If above 1:1 you may benefit from changing your diet.

Gamma linoleic acid (GLA)
When we consume anti-inflammatory nutrients such as GLA, it balances the inflammatory properties of AA and other pro-inflammatory nutrients. GLA provides a completely different set of benefits with its much-needed anti-inflammatory properties.
As mentioned, an excess of some types of omega-6 fatty acids can cause abnormal inflammation in our body, and we need GLA to neutralize and reverse this effect. The primary sources of GLA are borage, evening primrose, echium, black currant seed and hempseed. Of all these sources, borage contains the highest amount of naturally occurring GLA. GLA also shows promise in lowering low-density lipoprotein (LDL) and triglyceride levels, while increasing high-density lipoprotein (HDL) concentration. Unlike other omega-6 fatty acids we don't have to worry about consuming too much GLA. Studies conducted using borage oil show that GLA is safe, even in larger amounts.

Gamma linolenic acid (GLA) is an unusual omega-6 fatty acid with powerful implications for human health. Adequate GLA is required to maintain a healthy balance of anti-inflammatory signaling molecules in the body. The enzyme that produces GLA from dietary fats decreases in activity with aging and in certain chronic conditions. Increasing GLA intake overcomes this deficiency and can restore a healthy balance to suppress chronic inflammation. GLA also may help to prevent inflammation-related changes implicated in the development of atherosclerosis

and cancer. GLA has proven benefits in inflammatory diseases such as eczema, asthma, and rheumatoid arthritis.

Linoleic acid (LA)
This is a carboxylic acid. Linoleic acid belongs to one of the two families of essential fatty acids, which means that the human body cannot synthesize it from other food components. It is found in nuts, butter, seeds and vegetable oils. Usually this fatty acid gets digested in our body and converted to another omega-6 fatty acid, GLA, delivering a range of health benefits arising from its anti-inflammatory effects.

FATTY ACIDS, OTHER

CIS-Monounsaturated Fatty Acids
These are Monounsaturated fatty acids.Monounsaturated fats (MUFAs) are good fats. Liquid at room temperature, they turn solid when they are chilled. Common sources of MUFAs are olive oil, avocados and nuts. Monounsaturated fats are a healthy alternative to the trans fats and refined polyunsaturated fats you find in most processed foods. These fats in the diet are beneficial and lower heart disease risk. It can help lower your LDL (bad) cholesterol level. Cholesterol is a soft, waxy substance that can cause clogged, or blocked, arteries (blood vessels). Keeping your LDL level low reduces your risk of heart disease and stroke

Having a monounsaturated fatty acid index of < 19.0% increases heart disease risk, and indicates the need to increase intake of olive oil and or canola oil in salads or use more of these oils in cooking. Monounsaturated fatty acids have one double bond in the fatty acid chain with all of the remaining carbon atoms being single-bonded.

Saturated Total
This fat is a type of fat in which the fatty acids all have single bonds. These fats are saturated with hydrogen and carbon atoms.

A fat is made of two kinds of smaller molecules: monoglyceride and fatty acids. Fats are made of long chains of carbon (C) atoms. Some carbon atoms are linked by single bonds (-C-C-) and others are linked by double bonds (-C=C-). Double bonds can react with hydrogen to form single bonds. They are called saturated, because the second bond is broken up and each half of the bond is attached to (saturated with) a hydrogen atom. Most animal fats are saturated.

Trans fats
These are made through the chemical process of hydrogenation of oils. Hydrogenation solidifies liquid oils and increases the shelf life and the flavor stability of oils and foods that contain them. Trans fats wreak havoc with the body's ability to regulate cholesterol and they drive up the LDL ("bad") cholesterol which increases the risk of coronary artery heart disease and stroke. It's also associated with a higher risk of developing type 2 diabetes. Trans fats, or trans fatty acids, are a form of unsaturated fat. Unlike saturated fats, which have no double bonds, unsaturated fats

have at least one double bond in their chemical structure. This double bond can be either in the “cis” or “trans” configuration, which relates to the position of hydrogen atoms around the double bond. Basically… “cis” means “same side,” which is the most common structure. But trans fats have the hydrogen atoms on opposite sides, which can be a problem. The bottom line is trans fats are unsaturated fats with a specific chemical structure, where the hydrogen atoms are on opposite sides of the double bond.

GASTROINTESTINAL FUNCTIONS REPORT

DIGESTIVE FUNCTION

Colon Peristalsis
This is the movement of the waist through the bowel (small and large intestines).

Colonic Absorption
It is the uptake of water, electrolytes such as sodium, amino acids, and some drugs by the mucosa of the large bowel. Source

Gastric Absorption
This is the absorption of water, alcohol, and some salts through the gastric mucosa.

Gastric Peristalsis
This is the automatic weave-like movement of the muscles that line your gastrointestinal tract beginning in the throat when you swallow moving down through the stomach and intestines while you digest.

Hydrochloric Acid (HCL) Production
Hydrochloric acid constitutes the majority of gastric acid, the human digestive fluid. In a complex process and at a large energetic burden, it is secreted by parietal cells (also known as oxyntic cells). These cells contain an extensive secretory network (called canaliculi) from which the HCl is secreted into the lumen of the stomach. They are part of the epithelial fundic glands (also known as oxyntic glands) in the stomach. The chemical compound hydrochloric acid is the aqueous (water-based) solution of hydrogen chloride gas (HCl).

Intestinal Bacteria
The normal bacteria (flora) of the gut perform important functions, helping to digest certain vitamins like folic acid and vitamin K, and they protect the intestine from being invaded by disease-causing bacteria. However, if the normal function of the intestine is compromised, bacterial overgrowth may occur. This may be the result of a lack of adequate stomach acid, damage to the intestine by toxins like alcohol, or a decrease in the speed at which the small intestine transfers material to the colon.

Intraluminal Pressure
This is the relationship between contractions that traverse the entire length of the esophagus and the segmental movement of the colon.

Pepsin Secretion
Pepsin is an enzyme that breaks down proteins into smaller peptides (that is, a protease). It is produced in the stomach and is one of the main digestive enzymes in the digestive systems of humans and many other animals, where it helps digest the proteins in food. Pepsin has a three dimensional structure, of which one or more polypeptide chains twist and fold, bringing together a small number of amino acids to form the active site, or the location on the enzyme where the substrate binds and the reaction takes place. Pepsin is an aspartic protease, using a catalytic aspartate in its active site.

It is one of three principal proteases in the human digestive system, the other two being chymotrypsin and trypsin. During the process of digestion, these enzymes, each of which is specialized in severing links between particular types of amino acids, collaborate to break down dietary proteins into their components, i.e., peptides and amino acids, which can be readily absorbed by the small intestine. Pepsin is most efficient in cleaving peptide bonds between hydrophobic and preferably aromatic amino acids such as phenylalanine, tryptophan, and tyrosine.

Small Intestine Nutrient Absorption
This relates to the overall ability for the small intestine to absorb nutrients during the digestive process. Indications of abnormal readings can relate to issues with the lining of the colon as well as excessive mucoid plaque build or parasitic issues and overall tissue health decline.

Small Intestine Peristalsis
Once processed and digested by the stomach, the milky chyme is squeezed through the pyloric sphincter into the small intestine. Once past the stomach, a typical peristaltic wave only lasts for a few seconds, traveling at only a few centimeters per second. Its primary purpose is to mix the chyme in the intestine rather than to move it forward in the intestine. Through this process of mixing and continued digestion and absorption of nutrients, the chyme gradually works its way through the small intestine to the large intestine.

INFLAMMATION / OXIDATION

Cortisol Dysfunction
This prolonged or exaggerated stress response could perpetuate cortisol dysfunction, widespread inflammation, and pain. Cortisol dysfunction correlates with adrenal dysfunction as cortisol is secreted by the adrenal glands in response to stress. Cortisol dysfunction can lead to the following: weight gain and obesity, gastrointestinal distress, immune system suppression, cardiovascular disease, and fertility problems. It can also affect thyroid function, insomnia, chronic fatigue syndrome, dementia, depression and other problems. Exaggerated psychological responses as a result of perceiving potential stressors as threatening may worsen cortisol secretion by facilitating fear-based activation of the amygdala.

Cytokine Activity
A cytokine is a small protein released by cells that has a specific effect on the interactions between cells and on communications between cells. Clinical and experimental studies indicate that stress and depression are associated with the up-regulation of the immune system, including increased production of pro-inflammatory cytokines. Pro-inflammatory cytokines are implicated in many conditions including psoriasis, Chronic Fatigue Syndrome, Lyme, nerve pain, migraines, etc. Excess cytokines contribute to elevated C-reactive protein in the body.

Fibrinogen
This is a glycoprotein in vertebrates that helps in the formation of blood clots.

Hs-CRP
This highly sensitive C-reactive protein (CRP) is produced by the liver. The level of CRP rises when there is inflammation throughout the body. It is one of a group of proteins called “acute phase reactants” that go up in response to inflammation. Both CRP and hs-CRP become elevated in a wide range of acute and chronic inflammatory conditions such as infections, rheumatic arthritis, many other inflammatory diseases, and many cancers. These conditions cause release of interleukin-6 and other cytokines that trigger the synthesis of CRP by the liver. Because there are many disparate conditions that can increase CRP and hs-CRP, an elevated CRP level does not indicate a specific disease although in blood tests it is used to predict risk for future heart disease.

Homocysteine
As a general marker of overall health status, few tests carry greater predictive weight than homocysteine. The amount of homocysteine in your blood is one of the best objective indicators of how healthy you are and how long you are going to live. Having high homocysteine over the long term significantly increases your risk of every chronic health condition that we know of, including many varieties of cancer.

A high blood level of homocysteine is a reliable risk factor for each of the following:

- Myocardial infarction (heart attack)
- Cerebrovascular accident (stroke)
- Cancer
- Diabetes
- Thyroid-related health challenges
- Neurological conditions like Parkinson's and Alzheimer's
- Depression
- Infertility
- Chronic Pain
- Digestive Disorders

High blood level of homocysteine hurts your health in the following ways:

- Speeds Up Oxidation and Aging
- Causes Damage to Your Arteries
- Causes Your Immune System to Weaken
- Increases Pain and Inflammation

Histamine
This is essential for us to properly function and fight off invading toxins. When histamine accumulates faster than we can break it down, it triggers inflammation in patterns of histamine intolerance unique to each person and episode. Histamine can manifest with less obvious symptoms like headaches, foggy thinking, diarrhea, arrhythmia, sinus congestion, or itchy skin appearing within minutes or even several hours after exposure. Extreme histamine levels can trigger breathing difficulty and swelling called anaphylaxis.

Lp-PLA2
This (Lipoprotein-associated phospholipase A2) is used as a marker for cardiac disease. It is an enzyme produced by inflammatory cells and hydrolyzes oxidized phospholipids in LDL. Elevations of this enzyme indicate serious inflammation in artery walls that can be dangerous when blood pressure is high.

Myeloperoxidase
This is an enzyme made by white blood cells. High levels are a sign of surface inflammation of the artery wall. High levels are associated with future risk of coronary artery disease, heart failure, heart attack, and stroke in healthy individuals. Myeloperoxidase deficiency is a hereditary deficiency of the enzyme, which predisposes to immune deficiency.

nf-Kappa b
This is a protein complex that controls transcription of DNA, cytokine production and cell survival. NF-κB is found in almost all animal cell types and is involved in cellular responses to stimuli such as stress,cytokines, free radicals, heavy metals, ultraviolet irradiation, oxidized LDL, and bacterial or viral antigens. NF-κB plays a key role in regulating the immune response to infection (κlight chains are critical components of immunoglobulins). Incorrect regulation of

NF-κB has been linked to cancer, inflammatory and autoimmune diseases, septic shock, viral infection, and improper immune development. NF-κB has also been implicated in processes of synaptic plasticity and memory.

Sedimentation Rate
A sedimentation rate is a common blood test that is used to detect and monitor inflammation in the body. The sedimentation rate is also called the erythrocyte sedimentation rate because it is a measure of the red blood cells (erythrocytes) sedimenting in a tube over a given period of time.

INSULIN RESISTANCE

Adiponectin
This is a mixture of anti-inflammatory peptides secreted by fat cells, helps regulate energy balance and the metabolism of sugars and fats, as well as increasing insulin sensitivity. Adiponectin is a protein produced by body fat that protects against insulin resistance and inflammation. Adiponectin levels are low in those who are overweight. If you have low adiponectin levels you are at greater risk for diabetes and heart disease.

Alpha-hydroxybutyrate (a-HB)
This is a small molecule produced by the liver during energy production, especially when the body is under stress. High levels of a-HB are an early indicator of insulin resistance and may signal increased risk of prediabetes and diabetes.

Ferritin
This is a protein that binds iron and transports it through the bloodstream. Very high levels can indicate problems with your body's ability to store iron. Increased ferritin levels can also occur when insulin resistance and/or inflammation are present in the body, indicating increased risk for heart disease and diabetes.

Free Fatty Acids (FFA)
Elevated FFA level can impair your body's response to insulin and cause your blood glucose levels to rise. Higher FFA levels are a precursor to insulin resistance.

Ghrelin
This is a peptide hormone produced in the stomach that signals the hypothalamus to stimulate appetite and food intake. It is able to modify glucose and insulin metabolism, blood pressure levels, adipogenesis and inflammatory processes. Stress and inconsistent eating patterns cause

and overproduction of ghrelin and result in digestive issues. When ghrelin levels stay high people overeat and eat snacks contributing to weight gain.

HOMA-IR
This stands for Homeostatic Model Assessment of Insulin Resistance. The meaningful part of the acronym is “insulin resistance”. It marks for both the presence and extent of any insulin resistance that you might currently express. It is a terrific way to reveal the dynamic between your baseline (fasting) blood sugar and the responsive hormone insulin.

Healthy Range: 1.0 (0.5-1.4)

Less than 1.0 means you are insulin-sensitive which is optimal.
Above 1.9 indicates early insulin resistance.
Above 2.9 indicates significant insulin resistance.

Leptin
This is secreted by fat cells. It is supposed to notify the brain when enough food has been eaten to keep energy levels high, and stimulate appetite to turn off. Leptin levels decrease when people go on calorie restricted diets which signals the brain to bump up appetite and decrease metabolism to conserve energy. Once calorie intake is increased the body still believes it is starving with its fat stores too low and will protectively pack the fat away, especially in the midsection. Eating several small meals throughout the day keeps insulin and leptin levels elevated which then creates leptin resistance in the hypothalamus and pancreas. This results in constant hunger and excess fat storage.

Leptin/BMI Ratio
Lower leptin levels, when adjusted by BMI, are associated with an increased overall mortality and leptin/BMI ratio has high negative predictive value for mortality at 2 years.

IRI Score
Individuals insulin resistance level and diabetes risk.

Linoleoyl-Glycerophosphocholine (L-GPC)
Low levels are a marker of insulin resistance and glucose intolerance.

Oleic Acid
Oleic acid, or Omega-9, is a pale yellow, oily liquid with a lard-like odor. It is also a monounsaturated fatty acid. Fatty acids are the main components of food fats, oils and fat deposits in animals and man. Besides the work they do inside the body, monounsaturated fats like oleic acid are less susceptible to spoilage than some other fats, which makes them useful in food preservation.

PANCREAS BETA-CELL

Anti-GAD (IU/mL)
This is a type of antibody that is created when your beta cells are being attacked by your immune system.

C-peptide (ng/mL)
This is a small protein that is released when insulin is created from proinsulin.

Proinsulin (pmo/L)
Insulin is created from a non-active form called proinsulin. High levels of proinsulin may be early signs of damage to your beta cells of the pancreas.

Proinsulin: C-peptide Ratio
This is the ratio between proinsulin and c-peptide.

PANCREAS GLYCEMIC CONTROL

Blood Glucose
The excess glucose in the blood can lead to diabetes and may have long term complications.

Fructosamine
Fructosamina are compounds that result from glycation reactions between a sugar (such as fructose or glucose) and a primary amine, followed by isomerization via the Amadori rearrangement.

Glycation Gap
Glycation gap (GG) is defined as the difference between the measured level of HbA1c and the level that would be predicted from its regression on the fructosamine level. The aims of the study were: 1) To determine the reproducibility and consistency of GC; 2) To discover factors related to GG value.

HbA1c
These levels indicate how well your blood glucose has been controlled over the last 3-4 months. High levels indicate risk for the development of diabetes.

Insulin secretion
Insulin is a hormone responsible for regulating blood glucose levels. High levels of insulin may indicate a problem with your body's ability to control blood sugar.

Postprandial Glycemic Index (PPGi)
This indicates the glycemic levels after food has been consumed to identify the glycemic load.

MERIDIAN

Governing Vessel
Heavily focused on Mind and body, this pathway deals with the brain, spinal cord and reproductive organ pathway. This pathway is also known as the reserves. Helps regulate mental balance. This pathway can also be tied to the Large intestine, stomach, small intestine, urinary bladder, triple burner point and gallbladder. This point is considered one of the most important due to its impact structure.

Conception Vessel
Uterus (in Females) also tied to the Stomach, Kidney, Liver and Spleen. This pathway is tied to the brain and connects to Kidney and Heart.

Triple Warmer
Primary control is fight, flight or freeze response usually triggered by high stress situations. Organ relationships are Lungs, Spleen Kidney, Small intestine and Bladder. Triple warmer works with the Thyroid, Thymus and adrenal glands during a fight or flight response and helps to manage stress. The Pericardium also supports the heart during such stress and is also tied to this meridian matrix.

NUTRITIONAL ANALYSIS REPORT

AMINO ACIDS

Alanine
Is a non-essential amino acid that helps the body convert glucose and eliminate excess toxins from the liver. Alanine is crucial for preserving balanced levels of nitrogen and glucose in the body. Helps protect cells from damage during aerobic activity. Needed to process the B vitamins. Found in meat, poultry, eggs, dairy, fish and avocado.

Arginine (L-arginine)
It is considered an amino acid that is needed to keep the liver, skin, joints, and muscles healthy. Arginine helps strengthen the body's immune system by increasing the output of T lymphocytes

(T- cells) from the thymus gland, regulates hormones and blood sugar, and promotes male fertility. In addition, research has shown that this amino acid may improve circulation and treat impotence and heart disease. Arginine is involved in a variety of hormonal processes in the body. It stimulates the pancreas to release insulin, is used to make the pituitary hormone vasopressin, and regulates the production of growth hormone.

Asparagine (L-asparagine)
This is a non-essential amino acid involved in the metabolic control of cell functions in the nerve and brain function. It helps maintain equilibrium of the central nervous system. Low levels of asparagine may indicate poor metabolism or synthesis of aspartic acid, which can result in the inability to properly synthesize and excrete urea, which is the major waste product of excess dietary protein. The inability to excrete urea can result in buildup of nitrogen-containing toxic metabolites that can lead to confusion, headaches, depression, irritability, or, in extreme cases, psychosis.

Aspartic acid (L-aspartate)
This is thought to help promote a robust metabolism, and is sometimes used to treat fatigue and depression. This amino acid helps transport minerals needed to form healthy RNA and DNA to the cells, and strengthens the immune system by promoting increased production of immunoglobulins and antibodies (immune system proteins). Aspartic acid keeps your mind sharp by increasing concentrations of NADH in the brain, which is thought to boost the production of neurotransmitters and chemicals needed for normal mental functioning.

Cysteine
This is found in beta-keratin, the main protein in nails, skin and hair. It helps maintain a healthy, youthful appearance by encouraging collagen production and skin elasticity. N-acetyl cysteine (NAC) is a form of the amino acid cysteine that is most easily absorbed from supplements. NAC may be effective in the prevention and/or treatment of cancer, heavy metal poisoning, smoker's cough, bronchitis, heart disease, cystic fibrosis, acetaminophen poisoning, and septic shock. Its detoxifying effects may also help enhance the benefits of regular exercise by protecting the body from oxidative stress.

Glutamic acid (glutamate)
This is an excitatory neurotransmitter that increases the firing of neurons in the central nervous system. It is a major excitatory neurotransmitter in the brain and spinal cord. It is converted into either glutamine or Gamma-Aminobutyric Acid (GABA), two other amino acids that help pass messages to the brain. Glutamic Acid is important in the metabolism of sugars and fats, and aids in the transportation of potassium into the spinal fluid and across the blood-brain barrier. It is found at high levels in the blood and may infiltrate the brain in small amounts. The brain can use glutamic acid as fuel.

Glutamine
This is an amino acid that helps build and maintain the muscles of the body. It also helps remove toxic ammonia from the liver and helps maintain a healthy central nervous system.

Glutamine easily passes through the blood-brain barrier. Glutamine is also an important source of energy for the nervous system. If the brain is not receiving enough glucose, it compensates by increasing glutamine metabolism for energy. Glutamine promotes a healthy digestive tract by helping to balance acid/alkaline levels in the body. Glutamine also protects the liver from the effects of alcohol and acetaminophen overdose.

Glycine
This is one of the non-essential amino acids and is used to help create muscle tissue and convert glucose into energy. It is also essential to maintaining healthy central nervous and digestive systems. Glycine is used in the body to help construct normal DNA and RNA strands-the genetic material needed for proper cellular function and formation. It helps prevent the breakdown of muscle by boosting the body's levels of creatine, a compound that helps build muscle mass.

Histidine
This is an amino acid that is used to develop and maintain healthy tissues in all parts of the body, particularly the myelin sheaths that coat nerve cells and ensure the transmission of messages from the brain to various parts of the body. Acts as a natural detoxifier in the body. People with bipolar disorder should not take histidine.

Isoleucine
This is a branched-chain essential amino acid that is best known for its ability to increase endurance and help heal and repair muscle tissue and encourage clotting at the site of injury. It also keeps energy levels stable by helping to regulate blood sugar; a deficiency of isoleucine produces symptoms similar to those of hypoglycemia, and may include headaches, dizziness, fatigue, depression, confusion, and irritability.

Leucine
This works with the amino acids isoleucine and valine to repair muscles, regulate blood sugar, and provide the body with energy. It also increases production of growth hormones, and helps burn visceral fat, which is located in the deepest layers of the body and the least responsive to dieting and exercise.

Lysine
This is an essential amino acid known for its antiviral properties. It helps prevent outbreaks of herpes and cold sores, and is needed for hormone production and the growth and maintenance of bones in both children and adults. Lysine is involved in the production of antibodies for a strong, healthy immune system, which may be part of the reason it is so effective at fighting herpes viruses. This amino acid promotes the formation of both collagen and muscle protein, and may help speed recovery from surgery and sports injuries as well.

Methionine
This is an essential amino acid that helps the body process and eliminate fat. It contains sulfur, a substance that is required for the production of the body's most abundant natural antioxidant,

glutathione. Methionine is essential for the formation of healthy collagen used to form skin, nails, and connective tissue, and helps reduce the level of inflammatory histamines in the body.

Phenylalanine
This is an essential amino acid that is needed for normal functioning of the central nervous system. The body needs phenylalanine to make epinephrine, dopamine, and norepinephrine, three neurotransmitters that basically control the way you perceive and interact with your environment. Phenylalanine supplementation may help you feel happier, less hungry and more alert; it also has to treat chronic pain and improve memory and concentration. Phenylalanine, which aids in melatonin production, may be effective for treatment of vitiligo, a condition that causes white patches on the skin.

Proline
This helps the body break down proteins for use in creating healthy cells in the body. It is absolutely essential to the development and maintenance of healthy skin and connective tissues, especially at the site of traumatic tissue injury. It helps to keep muscles and joints flexible and helps reduce sagging and wrinkling that accompany UV exposure and normal aging of the skin. People with pain caused by insufficient cartilage or collagen formation could benefit from extra proline in their diet.

Serine
This helps form the phospholipids needed to make every cell in your body. It is also involved in the function of RNA and DNA, fat and fatty acid metabolism, muscle formation, and the maintenance of a healthy immune system. The proteins used to form the brain, as well as the protective myelin sheaths that cover the nerves, contain serine. Without serine, the myelin sheaths could fray and become less efficient at delivering messages between the brain and nerve endings in the body, essentially short circuiting mental function. Serine is also needed to produce tryptophan, an amino acid that is used to make serotonin, a mood-determining brain chemical. Both serotonin and tryptophan shortages have been linked to depression, insomnia, confusion, and anxiety. Research suggests that low levels of serine may contribute to chronic fatigue syndrome (CFS) and fibromyalgia (FM). Serine helps produce immunoglobulins and antibodies for a strong immune system, and also aids in the absorption of creatine, a substance made from amino acids that helps build and maintain all the muscles in the body, including the heart.

Threonine
This is an essential amino acid that promotes normal growth by helping to maintain the proper protein balance in the body. Threonine also supports cardiovascular, liver, central nervous, and immune system function. Threonine is needed to create glycine and serine, two amino acids that are necessary for the production of collagen, elastin, and muscle tissue. Threonine helps keep connective tissues and muscles throughout the body strong and elastic, including the heart, where it is found in significant Tyrosine is a non-essential amino acid that helps regulate mood and stimulates the nervous system. It can also help speed up the metabolism and treat conditions characterized by chronic fatigue.

Tryptophan
This is an essential amino acid. Your body uses tryptophan to make proteins, the B-vitamin niacin and the neurotransmitters serotonin and melatonin. However, in order to make niacin and serotonin, you also need to have sufficient iron, riboflavin and vitamin B6. L-tryptophan is used for insomnia, sleep apnea, depression, anxiety, facial pain, a severe form of premenstrual syndrome called premenstrual dysphoric disorder (PMDD), smoking cessation, grinding teeth during sleep (bruxism), attention deficit-hyperactivity disorder (ADHD), Tourette's syndrome, and to improve athletic performance.

Tyrosine
This is a non-essential amino acid that helps regulate mood and stimulates the nervous system. It can also help speed up the metabolism and treat conditions characterized by chronic fatigue. The body needs adequate supplies of tyrosine to make many important brain chemicals that help regulate appetite, pain sensitivity, and the body's response to stress. It is also needed for normal functioning of the thyroid, pituitary, and adrenal glands-low levels of tyrosine may lead to hypothyroidism, low blood pressure, chronic fatigue, and sluggish metabolism. It also helps build strong bones and tooth enamel, and may speed wound healing or recovery from injury. Without adequate amounts of phenylalanine, the body can't manufacture its own supply of tyrosine; without adequate amounts of tyrosine, the body cannot metabolize phenylalanine. A shortage of either of these amino acids could leave you vulnerable to a host of mental disorders, including anxiety, depression, low libido, and chronic fatigue.

Valine
This is a branched-chain amino acid (BCAA) that works with the other two BCAAs, isoleucine and leucine, to promote normal growth, repair tissues, regulate blood sugar, and provide the body with energy. Valine helps stimulate the central nervous system, and is needed for proper mental functioning. Valine helps prevent the breakdown of muscle by supplying the muscles with extra glucose for energy production during intense physical activity. Valine also helps remove potentially toxic excess nitrogen from the liver, and is able to transport nitrogen to other tissues in the body as needed. Valine may help treat liver and gallbladder disease, as well as damage to these organs caused by alcoholism and drug abuse. Valine may help treat or even reverse hepatic encephalopathy, or alcohol-related brain damage.

DIGESTIVE ACIDS / ENZYMES

Amylase
This is an enzyme that helps digest carbohydrates. It is made in the pancreas and the glands that make saliva. When the pancreas is diseased or inflamed, amylase is released into the blood. Increased blood amylase levels may occur due to:

Acute pancreatitis
Cancer of the pancreas, ovaries, or lungs
Cholecystitis
Gallbladder attack caused by disease
Gastroenteritis (severe)
Infection of the salivary glands (such as mumps) or a blockage
Intestinal blockage
Macroamylasemia
Pancreatic or bile duct blockage
Perforated ulcer
Tubal pregnancy (may have burst open)
Decreased amylase levels may occur due to:
Cancer of the pancreas
Damage to the pancreas
Kidney disease
Toxemia of pregnancy

Bile Acids
They have a detergent action on particles of dietary fat which causes fat globules to break down or be emulsified into minute, microscopic droplets. Emulsification is not digestion per se, but is of importance because it greatly increases the surface area of fat, making it available for digestion by lipases, which cannot access the inside of lipid droplets. Bile acids are lipid carriers and are able to solubilize many lipids by forming micelles – aggregates of lipids such as fatty acids, cholesterol and monoglycerides – that remain suspended in water. Bile acids are also critical for transport and absorption of the fat soluble vitamins.

Large amounts of bile acids are secreted into the intestine every day, but only relatively small quantities are lost from the body. This is because approximately 95% of the bile acids delivered to the duodenum are absorbed back into blood within the ileum. Each bile salt molecule is reused about 20 times, often two or three times during a single digestive phase. It should be noted that liver disease can dramatically alter this pattern of recirculation – for instance, sick hepatocytes have decreased ability to extract bile acids from portal blood and damage to the canalicular system can result in escape of bile acids into the systemic circulation. Assay of systemic levels of bile acids is used clinically as a sensitive indicator of liver disease.
Cellulase; humans do not produce cellulase, it must be ingested or created in the large intestine.

Cellulase
Cellulases break down the cellulose molecule into monosaccharides (“simple sugars”) such as beta-glucose, or shorter polysaccharides and oligosaccharides. Cellulose breakdown is of considerable economic importance, because it makes a major constituent of plants available for

consumption and use in chemical reactions. The specific reaction involved is the hydrolysis of the 1,4-beta-D-glycosidic linkages in cellulose, hemicellulose, lichenin, and cereal beta-D-glucans. Because cellulose molecules bind strongly to each other, cellulolysis is relatively difficult compared to the breakdown of other polysaccharides such as starch.

Chymotrypsin

Chymotrypsin is a digestive enzyme that breaks down proteins (i.e., it is a proteolytic enzyme; it can also be referred to as a protease). It is naturally produced by the pancreas in the human body. Chymotrypsin, as a hydrolase type of enzyme (which means it adds a water molecule during the breakdown process) acts by catalyzing the hydrolysis of peptide bonds of proteins in the small intestine. It is selective for peptide bonds with aromatic or large hydrophobic side chains on the carboxyl side of this bond. Chymotrypsin also catalyzes the hydrolysis of ester bonds. the primary uses of chymotrypsin are as a digestive aid and as an anti-inflammatory agent. The presence and amount of chymotrypsin in a person's stool is sometimes measured for diagnostic purposes as a test of pancreatic function. Chymotrypsin, along with the other pancreatic enzymes, is most often used in the treatment of pancreatic insufficiency. Pancreatic insufficiency is characterized by impaired digestion, malabsorption and passing of undigested food into the stool, nutrient deficiencies, gas, and abdominal bloating and discomfort. Pancreatic deficiency also occurs in persons with cystic fibrosis, a rare inherited disorder. It may also occur in those with chronic pancreatitis, as well as in the elderly. Other conditions that could result in chymotrypsin deficiency include physical injuries, chemotherapy, and chronic stress.

Elastase

Pancreatic Elastase (PE) is a simple, noninvasive fecal marker for assessing exocrine pancreatic function, allowing the clinician to establish a prompt and reliable diagnosis with high degrees of sensitivity (90%-100%) and specificity (93%-98%) in suspected cases of pancreatic insufficiency. Sensitivity is lower in milder cases of pancreatic insufficiency, but is quite high (95%-100%) in moderate to severe cases. PE is a digestive enzyme secreted exclusively by the human pancreas. Its unique qualities provide the following clinical advantages:

- PE has a strong correlation with the gold standard test for pancreatic insufficiency.
- PE results are not affected by pancreatic enzyme replacement therapy; therefore, patients are not required to stop supplementation prior to stool collection.
- PE is not degraded during intestinal transit, nor is it affected greatly by increases or decreases in intestinal transit times.
- PE levels are 5-fold to 6-fold higher in feces than in duodenal juice, reflecting the extraordinary stability of PE in the gastrointestinal (GI) tract.
- PE is produced exclusively in the pancreas and as such has almost absolute pancreatic specificity, There is little or no interference by other enzymes in the GI tract.

PE can be used to diagnose enzyme needs. PE is also useful in monitoring exocrine pancreatic function caused by: – Chronic pancreatitis – Autoimmune Myopathies and connective tissue diseases – Chronic Inflammatory Bowel Disease (IBD)

Hydrochloric Acid (HCl)
HCl's important functions include:

1. Breaking down proteins into the essential amino acids and nutrients your body needs in order to stay healthy.
2. Stimulates your pancreas and small intestines to produce the digestive enzymes and bile necessary to further breakdown the carbohydrates, proteins and fats you eat.
3. Preventing disease by killing pathogenic bacteria and yeast normally present in food. As you age, your stomach acid tends to decrease anyway. Add a poor diet of processed foods and you may find that you have both digestive and immune problems.

There are two main consequences of low stomach acid:

You become protein malnourished. When your stomach acid is low, you are not able to digest protein.

1. Improper digestion of protein creates toxins in your intestines that can set the stage for illness and disease.
2. Improper digestion of protein also creates acidic blood, since protein is by nature acidic.

You become mineral deficient. As your blood becomes more acidic, it will look for minerals from anywhere in your body, in order to get your blood to its more ideal alkaline state. Acidic blood robs your body of minerals, even taking minerals from your bones (which is important to know if you want to prevent osteoporosis).

Low stomach acid eventually creates a vicious cycle: low stomach acid = low minerals = acidic blood. This cycle continues because acidic blood further creates low minerals and low stomach acid.

Once this vicious cycle has started, there is a cascade of consequences:

You could eat plenty of protein and still be protein malnourished. This raises cortisol levels (stress or death hormone), thereby raising your blood glucose (blood sugar levels). Elevated cortisol adversely affects your behavior and temperament.

Eventually, your adrenals become depleted (adrenal fatigue), and DHEA, the youth hormone, is suppressed, leading to premature aging.

Low DHEA and high cortisol affect your brain and behavior, but that's not all. The vicious cycle of low stomach acid affects your inner ecosystem too. Low stomach acid can lead to more bad guys (pathogenic bacteria, candida and viruses) than good guys (healthy microflora), thus lowering your immunity.

Here are some of the common symptoms and disorders caused by low stomach acid:

Bloating, belching, and flatulence immediately after meals
Heartburn (often thought to be caused by too much stomach acid)
Indigestion, diarrhea, or constipation
Undigested food in stools
Acne
Rectal itching
Chronic Candida
Hair loss in women
Multiple food allergies
Iron deficiency
Weak, peeling, or cracked fingernails
Chronic fatigue
Adrenal fatigue
Dry skin
Various autoimmune diseases

Here are the 3 key ways to increase your stomach acid:

1. Reduce or eliminate sugar.
2. Add fermented foods and drinks to your diet.
3. Eliminate processed foods.

The following are some of the causes that are responsible for higher stomach acid production:

- Diet, increased consumption of spicy foods and oily foods increases the extent of acid production.
  ige
- If you consume foods that are very rich in fiber content, it takes a long time for the food to pass through the stomach. As a result, the acid production continues until the stomach is emptied, resulting in an increased amount of acid in the stomach.

- Stomach ulcer or cancers that increase the production of gastrin automatically increase the acid production.

- Stress is the major cause for a great number of ailments in the body. It is found that individuals who are severely stressed produce increased amounts of acid in the stomach.

- Bacterial infection by the bacterium H. pylori is also found to increase the acid production.

- Irregular meals like not having meals regularly at a particular time. Existence of a long gap between meals results in accumulation of the secreted acid in the stomach.

- In some people, lack of sufficient sleep also increases the acid production.

In majority of the cases, increased acid production is mainly due to dietary habits. To know if foods are responsible for increased acidity, cultivate the habit of noting down the foods you have taken and the time you have developed acidity. Correlation of both the details shows the presence of any existing relation between foods consumed and the cause of increased stomach acid. If having certain foods is repeatedly associated with acidity, quit the food to obtain relief from the problem.

If the daily routine is keeping you busy and preventing you from having timely meals, try to nibble something in the middle. This helps to keep the acid levels in the stomach under control.

Lactase
Lactase is essential to the complete digestion of whole milk; it breaks down lactose, a sugar which gives milk its sweetness.

Lipase
Lipases perform essential roles in the digestion, transport and processing of dietary lipids.

Maltase
Maltase breaks down the disaccharide maltose into two glucose molecules, which are easily oxidized by the body for energy. In simple words, maltase is an important part of the enzymatic process that our bodies use to effectively digest starches and sugars present in grains and other plant-based foods we eat daily.

This enzyme is synthesized in the lining of the intestinal wall and used with the cells inside our mucous membranes. Beginning in the oral cavity, maltase works with other carbohydrate-digesting enzymes to break down starches and complex sugars into simpler, more-digestible pieces. Maltase is one of the most important enzymes in our digestive process, as it is a key enzyme in the mouth and the saliva. The enzyme maltase helps to relieve the burden of digestion on the pancreas and the small intestine. Without this important enzyme, the small intestine has a much harder time breaking down sugars and starches. In this way, maltase helps the entire digestive system function smoothly. Similarly, having enough maltase present in the gut may lower irritation and support multiple health benefits beyond digestion.

Pepsin
This enzyme is produced in the mucosal lining of the stomach that acts to degrade protein. Pepsin is one of three principal protein-degrading, or proteolytic, enzymes in the digestive system, the other two being chymotrypsin and trypsin. During the process of digestion, these enzymes, each of which is particularly effective in severing links between particular types of amino acids, collaborate to break down dietary proteins to their components, i.e.,peptides and amino acids, which can be readily absorbed by the intestinal lining. In the laboratory studies pepsin is most efficient in cleaving bonds involving the aromatic amino acids, phenylalanine,

tryptophan, and tyrosine. Pepsin is synthesized in an inactive form by the stomach lining; hydrochloric acid, also produced by the gastric mucosa, is necessary to convert the inactive enzyme and to maintain the optimum acidity (p H 1-3) for pepsin function.

Protease (Proteolytic Enzyme)

Peptidase or proteinase, is a type of enzyme that functions mainly to help us digest different kinds of proteins. They break down the bonds by a process known as hydrolysis and convert proteins into smaller chains called peptides or even smaller units called amino acids. Commonly found in plant sources like papaya and pineapple, proteases also play a key role in many physiological processes. Proteins have a complex folded structure requiring these types of enzymes to disassemble the molecule in very specific ways. Without proteases the intestinal lining would not be able to digest proteins, causing serious consequences to your health. Proteolytic enzymes are extremely important for the digestion of many foods. But their intestinal duties are not solely limited to digesting food. They also digest the cell walls of unwanted harmful organisms in the body and break down unwanted wastes such as toxins, cellular debris, and undigested proteins. In this way, protease helps digest the small stuff, so that our immune system can work hard to avoid toxin overload.

Secretin

Secretin is a hormone that controls parts of the digestive system and maintains water balance in the body. It's released by the duodenum, the upper part of the small intestine. Secretin is responsible for controlling pH in the stomach. pH refers to the concentration of acid. If the pH is too low, there is too much acid, and the organs can become damaged. If the pH is too high, there is not enough acid and the digestive system may not be able to break down food. So, it's important that there is the right amount of acid in the digestive system.

As food passes through your digestive system, secretin is released into the pancreas, stimulating this organ to release the acidic digestive fluids that break down your food. When too much acid is produced, secretin stimulates different cells in the pancreas that produce bicarbonate, a substance that neutralizes acid, thereby balancing the pH and ensuring that acid doesn't damage the organs. Secretin can also stop the production of acidic chemicals in the stomach, and it can cause the pancreas and gallbladder to release other chemicals that help with digestion.

The secretin stimulation test is done to check the digestive function of the pancreas. The following diseases may prevent the pancreas from working properly:

- Chronic pancreatitis
- Cystic fibrosis
- Pancreatic cancer

In these conditions, there may be a lack of digestive enzymes or other chemicals in the fluid that comes from the pancreas. This can reduce the body's ability to digest food and absorb nutrients.

Sucrase
This is a digestive enzyme secreted in the small intestine. Sucrase enzymes are located on the brush border of the small intestine. The enzymes congenital sucrase-isomaltase deficiency (CSID), genetic sucrase-isomaltase deficiency the hydrolysis of sucrose to fructose and glucose. Sucrose intolerance (also known as concy (GSID), or sucrase-isomaltase deficiency) occurs when sucrose is not secreted in the small intestine. With sucrose intolerance, the result of consuming sucrose is excess gas production and often diarrhea and malabsorption. Sucrase is secreted by the tips of the villi of the epithelium in the small intestine. Its levels are reduced in response to villi-blunting events such as celiac sprue and the inflammation associated with the disorder.

Trypsin
This is an enzyme of the hydrolase class, secreted as trypsinogen by the pancreas and converted to the active form in the small intestine, that catalyzes the cleavage of peptide linkages involving the carboxyl group of either lysine or arginine; a purified preparation derived from ox pancreas is used for its proteolytic effect indébridement and in the treatment of empyema.tryptic

MACROMINERALS

Calcium: A mineral found in many foods. The body needs calcium to maintain strong bones and teeth, where it supports their structure and hardness and to carry out many important functions. The body needs calcium to maintain strong bones and to carry out many important functions. The body also needs calcium for muscles to move and for nerves to carry messages between the brain and body. In addition, calcium is used to help blood vessels move blood throughout the body and to help release hormones and enzymes that affect almost every function in the human body.

Insufficient intakes of calcium do not produce obvious symptoms in the short term because the body maintains calcium levels in the blood by taking it from bone. Over the long term, intakes of calcium below recommended levels have health consequences, such as causing low bone mass (osteopenia) and increasing the risks of osteoporosis and bone fractures. Osteoporosis is a disease of the bones in older adults (especially women) in which the bones become porous, fragile, and more prone to fracture.

Chloride: One of the most important electrolytes in the blood. It helps keep the amount of fluid inside and outside of your cells in balance. It also helps maintain proper blood volume, blood pressure, and pH of your body fluids.

Magnesium: Magnesium is the central element in chlorophyll and the basis of early life on the planet. Magnesium is needed for more than 300 biochemical reactions in the body. It helps to maintain normal nerve and muscle function, supports a healthy immune system, keeps the heartbeat steady, and helps bones remain strong. It also helps regulate blood glucose levels and aid in the production of energy and protein. It plays an important role in the reactions that generate and use ATP, the fundamental unit of energy within the body's cells. Magnesium is a macro-mineral, which, unlike trace minerals, is needed by the body in large amounts. Calcium, sodium, and potassium are also macro-minerals. The average human body contains about 25 grams of magnesium, one of the six essential minerals that must be supplied in the diet. Once magnesium enters the body through food, supplements, or topical applications, it is broken down and released to form independent magnesium atoms, or "ions". In its ionic form, magnesium has a positive charge, commonly noted as Mg2+. Magnesium cations function as a part of the structure of the body through their presence in bone. But arguably more important is their function as cell regulators in hundreds of chemical reactions throughout the body.

Magnesium is crucial to more than 300 enzyme-driven biochemical reactions occurring in the body on a near constant basis. All nutrients used by the human body function as either: sources of energy, building blocks for body structures, elements needed to regulate and control the body's many functions. Like most vitamins, magnesium's role is primarily regulatory. It allows enzymes to function properly, which in turn enable a vast majority of the body's chemical reactions. Enzymes are the basis of the body's ability to function while supporting life. Many of the necessary chemical reactions that the body carries out, such as the breakdown of sugars in the digestive system, can only normally be performed under extreme heat or acidity. Enzymes, however, allow these reactions to occur without damaging the body's fragile tissues and organs. Yet enzymes do not function alone. Substances known as enzyme cofactors must regulate the functions of enzymes to control the rate of reactions within the body. These cofactors act as "keys" to switches within each enzyme, instructing it to start or stop activity.

Magnesium is one of the most common cofactors in the body. Its presence is crucial to: Glucose and fat breakdown, production of proteins, enzymes and antioxidants such as glutathione, creation of DNA and RNA, Regulation of cholesterol production.
Without enzyme cofactors-including both hormones and vital minerals such as magnesium-reactions could easily spiral out of control. In fact, even slight imbalances can chronically impact the body's level of performance and health.

Phosphorus: Next to calcium, phosphorus is the most abundant mineral in the body. These 2 important nutrients work closely together to build strong bones and teeth. About 85% of the body's phosphorus is in bones and teeth. Phosphorus is also present in smaller amounts in cells and tissues throughout the body. Phosphorus helps filter out waste in the kidneys and plays an essential role in how the body stores and uses energy. It also helps reduce muscle pain after a workout. Phosphorus is needed for the growth, maintenance, and repair of all tissues and cells, and to produce the genetic building blocks, DNA and RNA. Phosphorus is also needed to help balance and use other vitamins and minerals, including vitamin D, iodine, magnesium, and zinc.

Potassium: Potassium is a very important mineral for the proper function of all cells, tissues, and organs in the human body. It is also an electrolyte, a substance that conducts electricity in the body, along with sodium, chloride, calcium, and magnesium. Potassium is crucial to heart function and plays a key role in skeletal and smooth muscle contraction, making it important for normal digestive and muscular function. Potassium may play a role in preventing osteoporosis. Studies suggest that increasing potassium intake also reduces the risk of dying from cardiovascular disease, possibly because of potassium's blood pressure lowering effects. Studies show that people with a higher sodium-potassium ratio have a higher risk of heart disease and all-cause mortality. People who have a lot of potassium IN their diet have a lower risk of stroke.

Sodium: Sodium is an element that the body needs to work properly. Salt contains sodium. The body uses sodium to control blood pressure and blood volume. Your body also needs sodium for your muscles and nerves to work properly. Too much sodium in the diet may lead to High blood pressure in some people and A serious buildup of fluid in people with heart failure, cirrhosis of the liver, or kidney disease.

Sulfur: The third most abundant mineral in the body, sulfur, about half concentrated in your muscles, skin and bones, and is essential for life. Sulfur makes up vital amino acids used to create protein for cells and tissues and for hormones, enzymes, and antibodies. The body uses up its store daily so it must be continually replenished for optimal health and nutrition. Sulfur is needed for insulin production. Insulin controls carbohydrate metabolism, but insufficient sulfur makes it harder for the pancreas to produce enough insulin, and makes cells less able to absorb things from the blood, contributing to blood sugar problems.

Information came from these sites:

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MICROMINERALS

Boron

This is a mineral that is found in food and the environment. People take boron supplements as medicine. Boron is a vital trace mineral that is required for the normal growth and health of the body. Many dangerous conditions like arthritis and osteoporosis are naturally managed by boron, and it helps to reduce menopausal symptoms. Boron is also used for building strong

bones, treating osteoarthritis, as an aid for building muscles and increasing testosterone levels, and for improving thinking skills and muscle coordination. In more than 95% of cases, significant improvement was noticed by effectively increasing calcium integration into the cartilage and bone. Women sometimes use capsules containing boric acid, the most common form of boron, inside the vagina to treat yeast infections. People also apply boric acid to the skin as an astringent or to prevent infection; or use it as an eye wash.

Copper
It works with iron to help the body form red blood cells. It also helps keep the blood vessels, nerves, immune system, and bones healthy. Copper also aids in iron absorption. Copper combines with certain proteins to produce enzymes that act as catalysts to help several body functions. Some help provide energy required by biochemical reactions. Others are involved in the transformation of melanin for pigmentation of the skin and still others help to form cross-links in collagen and elastin and thereby maintain and repair connective tissues. This is especially important for the heart and arteries. Copper is an essential trace element that is vital to the health of all living things (humans, plants, animals, and microorganisms). In humans, copper is essential to the proper functioning of organs and metabolic processes. The human body has complex homeostatic mechanisms which attempt to ensure a constant supply of available copper, while eliminating excess copper whenever this occurs. Copper is one of a relatively small group of metallic elements which are essential to human health. These elements, along with amino and fatty acids as well as vitamins, are required for normal metabolic processes.

Chromium
Chromium is a metallic element that humans require in very small amounts for normal body functions, such as digesting food. Chromium exists in many natural foods including brewer's yeast, meats, potatoes (especially the skins), cheeses, molasses, spices, whole-grain breads and cereals, and fresh fruits and vegetables. It is an essential part of metabolic processes that regulate blood sugar, and helps insulin transport glucose into cells, where it can be used for energy. Chromium also appears to be involved in the metabolism of carbohydrate, fat, and protein.

Fluorine
Fluorine is critical to mammals in trace amounts. It strengthens the crystalline structure of bones and teeth, making them far less prone to breakage or decay. Most municipalities add fluorine salts to their water supply for this purpose.

Germanium
A versatile, health-giving substance that is found in high concentration in numerous medicinal plants. This remarkable nutrient is an oxygen catalyst, antioxidant, electro-stimulant and immune enhancer. Nutritionally, the natural element germanium has been known to aid in the prevention of cancer and AIDS. Certain compounds of germanium have toxic effects against certain bacteria. In its organic form, germanium is being hailed as one of the greatest new developments in the nutritional treatment of cancer.

The estimated daily intake for germanium is 1 mg. Germanium has been reported to improve the immune system, boost the body's oxygen supply, make a person feel more energetic, and destroy damaging free radicals. Germanium also protects against radiation.

Organic germanium is a biological-response modifier. This means it enables the body to change its response to tumors, which has therapeutic benefits. Germanium does not directly attack cancer cells, but stimulates the body's immune system, making it effective in the treatment of cancer as well as other degenerative diseases.

Germanium facilitates the movement of oxygen across cellular membranes to deliver oxygen into the cells. Dr. Otto Warburg, Nobel prize-winning cancer researcher, discovered that cancer cells do not metabolize oxygen properly. Flooding cells with oxygen may retard the growth of cancer cells or even help return them to normal.

A study published in the Journal of Interferon Research, concluded "…organic germanium restores the normal function of T-cells, B-lymphocytes, natural killer cell activity, and the numbers of antibody-forming cells…. Organic germanium has unique physiological activities without any significant side effects."

Germanium has been used to treat depression, arthritis, vision problems, elevated blood pressure, heavy metal poisoning, and cancer.

Iodine

Iodine is a non-metallic mineral which humans require in trace amounts for proper development and growth. It exists in most soils, and is taken up by plants which are in turn ingested by humans and animals. Most of the body's stores of iodine are in the thyroid gland. The body needs iodine to make thyroid hormones. These hormones control the body's metabolism and many other important functions. The body needs thyroid hormones for proper bone and brain development during pregnancy and infancy. Getting enough iodine is important for everyone, especially infants and women who are pregnant. Iodine also regulates all key metabolic functions including blood cell production and nerve and muscle function. Because our body heat is primarily derived from muscle metabolism, these hormones also regulate body temperature. Iodine is also extremely important for breast and prostate health.

Iron

Iron is a relatively common element in the universe, being found in stars and meteorites. Iron is an important component of hemoglobin, the substance in red blood cells that carries oxygen from your lungs to transport it throughout your body. Hemoglobin represents about two-thirds of the body's iron. If you don't have enough iron, your body can't make enough healthy oxygen-carrying red blood cells. A lack of red blood cells is called iron deficiency anemia. Without healthy red blood cells, your body can't get enough oxygen. "If you're not getting sufficient oxygen in the body, you're going to become fatigued."
The symptoms of moderate to severe iron deficiency anemia include:

general fatigue
weakness
pale skin
shortness of breath
dizziness
strange cravings to eat items that aren't food, such as dirt, ice, or clay
a tingling or crawling feeling in the legs
tongue swelling or soreness
cold hands and feet
fast or irregular heartbeat
brittle nails
headaches

Lithium

The mineral known for its efficacy against bipolar disorder, has become one of the most effective go-to for mental health. What many do not know, however, is that lithium offers a host of other lesser-known benefits, many of which go far beyond brain health.

1. Promotes Normal Brain Health; Studies have shown that lithium may increase grey matter volume in the prefrontal cortex region of the brain, most likely through the generation of new stem cells. This process is called neurogenesis, or the creation of new brain cells.

2. Supports Bone Health; The effects of calcium and phosphorus, two minerals integral to bone formation, may be enhanced through lithium supplementation. Some research indicates lithium's potential to support bone strength.

3. Promotes Focus and Attention; it was found that lithium was comparable at addressing the most common symptoms of short attention span and even secondary symptoms like mood imbalance.

4. Supports Immune Health; lithium may have potent immune-bolstering effects, simultaneously exerting immune stimulating properties along with activity against harmful organisms. One major mechanism is by decreasing the level of prostaglandin activity. Prostaglandins are tiny signalers in every cell of the body, modulating a variety of metabolic actions. Excessive prostaglandin activity can depress immune function; however, lithium may play a role in preventing its overproduction and immune-suppressing effects.

5. Encourages Longevity; Exciting research from Japan has demonstrated a strong correlation between lithium consumption and longevity. The study involved analyzing 18 water municipalities that consisted of over 1.2 million citizens. Results showed lower mortality rates from all causes in the population groups receiving higher levels of lithium

in the water supply. Research suggests that lithium may act as an antioxidant, possibly providing anti-aging, life-extension benefits.

Manganese
Manganese helps the body form connective tissue, bones, blood clotting factors, and sex hormones. It also plays a role in fat and carbohydrate metabolism, calcium absorption, and blood sugar regulation. Manganese is also necessary for normal brain and nerve function. Manganese is a component of the antioxidant enzyme superoxide dismutase (SOD), which helps fight free radicals. Free radicals occur naturally in the body but can damage cell membranes and DNA. They may play a role in aging, as well as the development of several health conditions, including heart disease and cancer. Antioxidants, such as SOD, can help neutralize free radicals and reduce or even help prevent some of the damage they cause. Low levels of manganese in the body can contribute to infertility, bone malformation, weakness, and seizures. It is easy to get enough manganese in your diet — this nutrient is found in whole grains, nuts, and seeds.

Molybdenum
Molybdenum is classified as a metallic element and found widely in nature in nitrogen-fixing bacteria. Molybdenum is essential in trace amounts. In humans and animals, molybdenum serves mainly as an essential cofactor of enzymes and aids in the metabolism of fats and carbohydrates. Humans need only very small amounts of molybdenum, which are easily attained through a healthy diet. Molybdenum in humans is to act as a catalyst for enzymes and to help facilitate the breakdown of certain amino acids in the body. Molybdenum combines with sulfite oxidase to catalyze sulfur-containing amino acids that are crucial for human health. Also, molybdenum is abundant in human tooth enamel and may have a role in lowering the risk of tooth decay.

Selenium
Selenium can play a protective role in the body because it increases antioxidant capabilities and the quality of blood flow, therefore enhancing the body's resistance against diseases and stress. Selenium is often praised for its role in antioxidant activity which lowers free radical damage and inflammation. This means that selenium benefits your body by helping to prevent common forms of cancer, to fight off viruses, defend against heart disease, and to slow down symptoms correlated with other serious conditions like asthma.

Selenium is also an essential trace mineral important for cognitive function, a healthy immune system and fertility for both men and women.
A study out of the Netherlands has linked selenium intake to a lower risk of prostate cancer.

Silicon
Silicon is known as a beautifying mineral and there are also many health benefits associated with it. It not only causes the strengthening of connective tissues and bones, but is also useful in taking care of nails, hair and skin. The health benefits of silicon also play a vital role in the prevention of atherosclerosis, insomnia, skin disorders and tuberculosis.

Silicon is the second most available element found in the earth's crust, and it is one of the most important elements used in high tech devices and semiconductors. Silicon is a vital trace mineral required by the body for strong and flexible joints, glowing skin and stronger bones.

Zinc

Zinc is a metal. It is called an "essential trace element" because very small amounts of zinc are necessary for human health. Zinc is used for treatment and prevention of zinc deficiency and its consequences, including stunted growth and acute diarrhea in children, and slow wound healing. Zinc is needed in small amounts every day to maintain health and perform important functions each day. Zinc helps with hormone production, growth and repairment; improves immunity and facilitates digestion. Zinc benefits also include its ability to act as an anti-inflammatory agent, therefore zinc may have significant therapeutic benefits for several common, chronic diseases like fighting cancer or reversing heart disease. Zinc is present within all bodily tissue and needed for healthy cell division. It acts like an antioxidant within the body, fighting free-radical damage and slows the aging process. Zinc also has a big impact on hormonal balance, so for this reason, even a small zinc deficiency can result in an increased risk for infertility or diabetes.

MINERAL RELATIONSHIP CHART

Nutrient	Agonist/Synergist	Antagonist
Vitamin A	Vitamins: B1, B2, B3, B6, B12, C, E Minerals: Ca, K, Mg, Mn, P, Se, Zn	Vitamins: D, E Minerals: Ca, Cu, Na, Se
Vitamin B1	Vitamins: A, B2, B3, B5, B6, B10, B12, C, E Minerals: Co, Cu, Fe, K, Mn, Mg, Na, P Se, Zn	Vitamins: B2, B6, B12 Minerals: Cu, K, Zn
Vitamin B2	Vitamins: A, B1, B3, B5, B6, B9, B10, B12 Minerals: Cr, Cu, Fe, K, Mg, P, Zn	Vitamins: B1 Minerals: Ca, Cu, Fe, Mn, Na, Se
Vitamin B3	Vitamins: A, B1, B2, B5, B6, B9, B10, B12, C, E Minerals: Cr, Cu, Fe, K, Mg, Mn, P, Na, Se, Zn	Vitamins: A Minerals: Ca, Cu, Na
Vitamin B5	Vitamins: A, B1, B2, B3, B6, B9, B10, B12, C, E Minerals: Cr, K, Na, P Zn	Minerals: Cu

Vitamin B6	Vitamins: A, B1, B2, B3, B5, B9, B10, B12, C, E Minerals: Cr, Cu, Fe, K, Mg, Mn, Na, P, Se, Zn	Vitamins: B1 Minerals: Ca, Cu, Fe
Vitamin B9 (Folic Acid/Folate)	Vitamins: B2, B3, B5, B6, B12, C Minerals: Cu, Fe, Mg, Zn	Minerals: Cu Metals: Al
Vitamin B10 (PABA)	Vitamins: B5, B9	Minerals: K, Mg, Zn
Vitamin B12	Vitamins: B1, B3, B5, B6, B9, B10, C, D, E Minerals: Ca, Co, Cu, Fe, Na, Se	Vitamins: B1, C Minerals: K, Mg, Zn
Vitamin C	Vitamins: A, B3, B5, B6, B9, B12, E Minerals: Ca, Co, Cu, Fe, Mg, Mn, Na, Se, Zn	Minerals: Cu Metals: Al
Vitamin D	Vitamins: B2, B3, B12, E, K Minerals: Ca, Cu, Mg, Mn, Na, P, Se	Vitamins: A Minerals: Ca, K, Mg, P, Zn
Vitamin E	Vitamins: A, B1, B2, B3, B5 B6, B9, B10, B12, C, D, K Minerals: Ca, Fe, K, Mn, Na, P, Se, Zn	Minerals: Ca, Fe, Mg, Mn, Zn
Vitamin K	Vitamins: A, B3, B6, C, E Minerals: Mn	Vitamins: A, E Minerals: Ca
Calcium	Vitamins: A, C, D, K Minerals: Mg	Vitamins: A, C, B1, B3, B6, E Minerals: Fe, K, Mg, Na, P, Zn Metals: Pb
Chromium	Vitamins: B3, B5, B6, C Minerals: K, Mg, Zn	Minerals: Ca, Fe, Mn, P Metals: Pb
Copper	Vitamins: B2, B6, B9, B12 Minerals: Ca, Co, Fe, Mn, Na, Se, Zn	Vitamins: A, B3, B5, B6, C Minerals: Fe, K, Zn Metals: Cd, Hg, Pb
Iron	Vitamins: B2, B9, B12, C Minerals: Cr, Cu, K, Mn, Na, P, Se	Vitamins: E Minerals: Ca, Cu, Mn, P, Zn Metals: Al, Hg, Pb
Magnesium	Vitamins: B1, B6, C, D Minerals: Ca, Fe, K, Mg, P, Zn	Vitamins: B9, B10, B12, D, E Minerals: Ca, Cu, Fe, Mn, Na, P Metals: Cd, Pb

Manganese	Vitamins: B1, C, K Minerals: Cu, Fe, Zn	Vitamins: B12, E Minerals: Ca, Cr, Cu, Fe, P Metals: Cd, Pb
Phosphorus	Vitamins: B's, D Minerals: Ca, Fe, K, Mg, Na, Zn	Vitamins: D Minerals: Ca, Cu, Fe, Mn, Mg, Zn
Potassium	Vitamins: B6, B10, D Minerals: Ca, Fe, Mg, Mn, Na, P, Zn	Vitamins: B1, B10, B12, D Minerals: Ca, Cu, Na
Selenium	Vitamins: B3, C, E Minerals: Ca, Cu, Fe, K, Mn, Na, Zn	Vitamins: A, B2 Metals: Al, Cd, Hg
Sodium	Vitamins: B6, D Minerals: Ca, Co, Cu, Fe, K, Mg, P, Se	Vitamins: A, B2, B3, Minerals: Ca, K, Mg, Zn
Zinc	Vitamins: A, B6, D, E Minerals: Cr, K, Mg, Mn, P	Vitamins: B1, B10, B12, D, E Minerals: Ca, Cu, Fe, P Metals: Al, Cd, Hg, Ni, Pb

VITAMINS / COENZYMES

B1, Thiamine

This is an essential nutrient that all tissues of the body need to function properly. Like the other B vitamins, thiamine is water-soluble and helps the body turn food into energy. The body needs thiamine to make adenosine triphosphate (ATP). This is a molecule that transports energy within cells.

A thiamine deficiency can impact many different functions of your body, including those of the nervous system, heart and brain. Conditions that can impair thiamine levels include alcoholism, Crohn's disease, and anorexia.

People who are undergoing dialysis for their kidneys or taking loop diuretics are also at risk for thiamine deficiency. Loop diuretics are prescribed for people with congestive heart failure. They can flush thiamine out of the body, possibly canceling out any health benefits. The heart relies on thiamine to function properly.

Thiamine deficiency can lead to two major health problems: beriberi and Wernicke-Korsakoff syndrome. Beriberi affects breathing, eye movements, heart function, and alertness. It's caused by a buildup of pyruvic acid in the bloodstream, which is a side effect of your body not being able to turn food into fuel. Wernicke-Korsakoff syndrome is technically two different disorders. Wernicke's disease affects the nervous system and causes visual impairments, a lack of muscle

coordination, and mental decline. If Wernicke's disease is left untreated, it can lead to Korsakoff syndrome. Korsakoff syndrome permanently impairs memory functions in the brain.

B2, Riboflavin
This is a water-soluble vitamin present in most animal and plant tissues. Riboflavin is one of the essential B vitamins, known to help support adrenal function, help calm and maintain a healthy nervous system, and facilitate key metabolic processes, including helping to turn food into energy. Riboflavin is involved in vital metabolic processes in the body, and is necessary for energy production and normal cell function and growth.

VItamin B2 is also crucial in helping other B vitamins undergo the chemical changes that make them useful. Emerging research shows that riboflavin/vitamin B2 can act as an antioxidant, potentially helping to prevent cancer and prohibit cholesterol buildup by controlling the proliferation of harmful molecules known as free radicals.

Dietary sources of riboflavin include: dairy products (such as milk, cheese and yogurt), eggs, enriched or fortified cereals and grains, meats, liver, dark greens (such as asparagus, broccoli, spinach and turnip greens), fish, poultry, and buckwheat. Keep in mind that riboflavin is easily destroyed by exposure to light, so buy milk and yogurt in paper cartons or containers.

Too little riboflavin can cause weakness, throat swelling/soreness, a swollen tongue, skin cracking (including cracked corners of the mouth), dermatitis, and anemia. Riboflavin/vitamin B2 deficiency can also affect vision, including blurred vision and itching, watering, sore, or bloodshot eyes, as well eyes becoming light-sensitive and easily fatigued.

B3, Niacin
This is one of the eight B-complex water-soluble vitamins. Niacin has a wide range of uses in the body, helping functions in the digestive system, skin and nervous system. Niacin comes in several forms, including niacinamide (nicotinamide) and inositol hexanicotinate. Each of these forms has various uses as well.

Food sources of niacin include yeast, meat, fish, milk, eggs, nuts, green vegetables, beans and enriched breads and cereals. The human body can also make niacin from the amino acid tryptophan.niacin helps the body break down carbohydrates, fats and proteins into energy. It plays a role in gland and liver function. Niacin has a role in producing certain hormones in the adrenal glands and helps remove harmful chemicals from the liver. It also can play a part in improving health.

According to NIH, it is also used for treating migraine headaches, circulation problems and dizziness, and to reduce the diarrhea associated with cholera. It is also used to lower cholesterol and triglycerides in the blood. B3 was found to improve the ability to maintain an erection in men with moderate to severe erectile dysfunction. More severe niacin deficiency can cause a condition called pellagra. The symptoms of pellagra include digestive problems,

inflamed or flakey skin, diarrhea and mental impairment. There is also a correlation between niacin deficiency and schizophrenia.

One side effect of taking niacin supplements is mild flushing. Ross described it as a feeling of warmth, itching, redness or a tingly feeling under the skin. The flushing is harmless and usually subsides within one or two hours.

B3, Nicotinamide (niacinamide)
This is the water-soluble, active form of vitamin B3. The broad clinical effects of nicotinamide may be explained by its role as a cellular energy precursor, a modulator of inflammatory cytokines, an inhibitor of the nuclear enzyme poly (adenosine diphosphate-ribose [ADP]) polymerase [PARP], which plays a significant role in DNA repair, maintenance of genomic stability, and cellular response to injury including inflammation and apoptosis (cell death).

B3 may repair damage to the brain caused by strokes. B3 may also be helpful to cancer patients. A recent study found that nicotinamide significantly reduces the incidence of nonmelanoma skin cancers in those with a history of basal cell carcinoma or squamous cell carcinoma.

Oral nicotinamide is generally well tolerated in doses under 3 g/day. It does not cause flushing or gastrointestinal upset, unlike its precursor nicotinic acid. It has been reported to increase sweating and raise blood sugar.

B5, Pantothenic Acid
This is a component of coenzyme A (CoA), an essential coenzyme in a variety of reactions that sustain life. CoA is required for chemical reactions that generate energy from food (fat, carbohydrates, and proteins). The synthesis of essential fats, cholesterol, and steroid hormones requires CoA, as does the synthesis of the neurotransmitter, acetylcholine, and the hormone, melatonin. Heme, a component of hemoglobin, requires a CoA-containing compound for its synthesis. Metabolism of many drugs and toxins by the liver requires CoA. Coenzyme A was named for its role in acetylation reactions. Both CoA and the acyl-carrier protein are required for the synthesis of fatty acids.

Administration of pantothenic acid orally and application of panthenol ointment to the skin have been shown to accelerate the closure of skin wounds and increase the strength of scar tissue. A pantothenic acid derivative called pantethine has been reported to have a cholesterol lowering effect.

B5 helps create red blood cells, create stress related and sex hormones, maintain a healthy digestive tract, process other B vitamins (especially riboflavin), and synthesize cholesterol.

B6, Pyridoxine
This is involved in no less than 100 different chemical reactions in your body per minute.

It functions mostly as a coenzyme – which is exactly what it sounds like. Vitamin B6 works with other enzymes to regulate all sorts of processes in your body.
Studies have shown the benefits of vitamin B6 in relieving edema and reducing water retention, improving magnesium deficiency, peripheral neuropathy, carpal tunnel syndrome, tendonitis, rheumatism, cardiovascular occlusions and myocardial infarcts, learning and developmental disorders, and autism.
Technically, vitamin B6 is an umbrella term given to three different vitamins, pyridoxine, pyridoxal, and pyridoxamine. The three B6 vitamins work together with other enzymes to speed up chemical reactions in cells.

Those processes include making amino acids, creating neurotransmitters like serotonin and metabolizing energy released in creating red blood cells. Vitamin B6 benefits also include helping to balance hormones and strengthen the immune system.

The activated form of vitamin B6, pyridoxal-5-phosphate or P-5-P, is the form of vitamin B6 that the body utilizes best. Because many people can't convert vitamin B6 to P-5-P, doctors recommend that at least 20% of the daily intake of vitamin B6 be in the form of a supplement containing P-5-P, the activated form of vitamin B6 in order to derive the maximum vitamin B6 benefits.

Vitamin B6 deficiency has been linked to depression, schizophrenia, autism and irritability. Studies have shown a deficiency of vitamin B6 in people diagnosed with epilepsy, acne, arthritis and seborrheic dermatitis.

Because the body requires vitamin B6 to properly metabolize so many different other enzymes and proteins, a vitamin B6 deficiency can potentially be at the root of many different disorders, including yeast infections, water retention, premenstrual syndrome, an impaired immune system, Parkinson's disease and arthritis.

Specifically, clinical studies have shown the benefits of vitamin B6 in treating:

- autism
- carpal tunnel syndrome
- asthma
- endometriosis
- premenstrual syndrome
- edema
- atherosclerosis
- acne
- attention deficit disorder
- schizophrenia
- clinical depression

In most cases, scientists believe that supplementing the diet with vitamin B6 allows the body to better utilize other supplements and medications, and improves the effectiveness of other treatments for those conditions.

Because your body uses vitamin B6 to help metabolize and use other enzymes and vitamins, it's important that you match your intake of B6 with equal doses of vitamins B12 and other vitamins in the B complex family. If those guidelines aren't followed, then long term doses of as little as 500 mg daily can result in the toxicity of vitamin B6. To avoid vitamin B6 overdose, nutrition experts suggest that vitamin B6 be taken with equal doses of other B vitamins and magnesium supplements.

Biotin

The health benefits of Vitamin B7 or Biotin include improved metabolism, tissue maintenance, healthy skin, weight loss, relief from heart problems, alopecia, Parkinson's disease, Rett syndrome and vaginal candidiasis. It also aids in the synthesis of vital components and helps in maintaining blood sugar levels.

Biotin, along with the other B-complex vitamins, has the main functions of helping your body to process energy, and of carrying carbon dioxide through your body. Your sweat glands, nerve tissue and bone marrow also function at their peak efficiency when you have proper Biotin levels.

Biotin may have an important role in the growth and maintenance of your hair and nails. If you suffer from a Biotin deficiency, you will typically experience hair loss and brittle nails, and taking supplements of this vitamin may help to halt this process. In many cases, taking a Biotin supplement may even help you to stimulate new hair and nail growth. Even though hair loss is rarely caused by a Biotin deficiency in your body, this problem can quite often be helped if you take Biotin supplements regularly.

Vitamin B9: (Folate)

All the B vitamins are water-soluble, meaning the body does not store them. Folic acid is crucial for proper brain function and plays an important role in mental and emotional health. Vitamin B9, also called folate or folic acid, is one of 8 B vitamins. All B vitamins help the body convert food (carbohydrates) into fuel (glucose), which is used to produce energy needed for a healthy liver, and healthy skin, hair, and eyes. Folic acid (Vitamin B9), also known as folate, functions as a coenzyme during the synthesis of genetic material (DNA). It is also a vital component for cellular division, and the normal growth, development, function, and reproduction of all cells. Folic acid plays a role in all processes that depend on cell division. Folic acid is necessary to help regulate the formation of both red and white blood cells. It also aids in the elimination of homocysteine from the body, a blood toxin which can negatively impact the heart muscle and contribute to the deposit of cholesterol in the heart. Folate helps to promote a healthy pregnancy by acting to regulate the development of the fetus' central nervous system. Folic acid is vital for all growth phases of human life.

Vitamin B12 (Cobalamin)
This plays a role in making DNA and also helps keep nerve cells and red blood cells healthy. Vitamin B12 is a water-soluble vitamin. It is responsible for the smooth functioning of several critical body processes. Vitamin B-12 has been looked at as a treatment for many diseases and conditions. These include fatigue, Alzheimer's disease, heart disease, breast cancer, high cholesterol, and sickle cell disease. The body needs B12 to convert homocysteine to methionine, protect DNA and RNA, support energy, protect nerve and brain cells, stimulate serotonin production, contribute to red blood cell formation, support immune function, and maintain a positive mood.

Many individuals cannot convert cobalamin into the active form called methylcobalamin. Methylcobalamin is the only form of B12 that can cross the blood-brain barrier without assistance or conversion. Its methyl group stimulates serotonin creation, a neurotransmitter responsible for mood support. It also works directly on brain cells to protect against damage from excitotoxins. Researchers have found large doses of methylcobalamin may offer therapeutic value for those suffering from ALS and multiple sclerosis. This is the only form of B12 that acts on the nervous system. A deficiency in B12 can lead to pernicious anemia. The most common cause of pernicious anemia is the loss of stomach cells that make intrinsic factor. Intrinsic factor helps the body absorb vitamin B12 in the intestine. The loss of parietal cells may be due to destruction by the body's own immune system.

Beta Carotene
This is an antioxidant which protects cells against oxidation damage that can lead to cancer. Beta carotene is converted, as needed, to vitamin A. Excessive carotene in the diet can temporarily yellow the skin, a condition called carotenemia.

CoEnzyme Q10
Coenzyme Q10 (CoQ10) is a substance that helps convert food into energy. CoQ10 is found in almost every cell in the body, and is a powerful antioxidant.

Antioxidants fight damaging particles in the body known as free radicals, which damage cell membranes, tamper with DNA, and even cause cell death. Scientists believe free radicals contribute to the aging process, as well as a number of health problems, including heart disease and cancer. Antioxidants, such as CoQ10, can neutralize free radicals and may reduce or even help prevent some of the damage they cause.

Some researchers believe that CoQ10 may help with heart-related conditions, because it can improve energy production in cells, prevent blood clot formation, and act as an antioxidant.

Some studies suggest that coenzyme Q10 supplements, either by themselves or in with other drug therapies, may help prevent or treat the following conditions:

- After Heart Attack
- Heart Failure

- High Blood Pressure
- High Cholesterol
- Diabetes
- Heart Damage caused by chemotherapy
- Heart Surgery
- Periodontal (Gum) Disease

Preliminary clinical studies also suggest that CoQ10 may:

Improve immune function in people with HIV or AIDS
- Increase sperm motility, improving male fertility
- Be used as part of the treatment for Parkinson disease
- Improve exercise ability in people with angina
- Help prevent migraines

Scientific studies are needed to see whether CoQ10 can be safely and effectively used for these health problems and needs.

Vitamin A (Retinoid)
This is important for normal vision, the immune system, and reproduction. Vitamin A also helps the heart, lungs, kidneys, and other organs work properly. Vitamin A is key for good vision, a healthy immune system, and cell growth. There are two types of vitamin A. This entry is primarily about the active form of vitamin A — retinoids — that comes from animal products. Beta-carotene is among the second type of vitamin A, which comes from plants.However, getting too much preformed vitamin A (usually from supplements or certain medicines) can cause dizziness, nausea, headaches, coma, and even death. High intakes of preformed vitamin A in pregnant women can also cause birth defects in their babies. Women who might be pregnant should not take high doses of vitamin A supplements.

Vitamin C
This is a water-soluble vitamin and powerful antioxidant, it helps the body form and maintain connective tissue, including bones, blood vessels, and skin. Vitamin C is important in the synthesis of collagen, the framework protein for tissues of the body. Deficiency leads to scurvy, characterized by fragile capillaries, poor wound healing, and bone deformity in children.

Vitamin D, 25-Hydroxy
This is a steroid vitamin which promotes absorption and metabolism of calcium and phosphorus which helps maintain healthy bones and teeth, and is suggested to supply a protective effect against multiple diseases and conditions such as cancer, type 1 diabetes and multiple sclerosis. Under normal conditions of sunlight exposure, no dietary supplementation is necessary because sunlight promotes adequate vitamin D synthesis in the skin. Vitamin D must go through several processes in your body before your body can use it. The first transformation occurs in the liver. Here, your body converts vitamin D to a chemical known as 25-hydroxyvitamin D, also called calcidiol. The 25-hydroxy vitamin D test is the best way to monitor vitamin D levels. The test can

determine if your vitamin D levels are too high or too low. D3 is up to 87% more effective than D2.

It is estimated that up to 85 percent of people have insufficient levels of vitamin D and are unaware of their deficient state. While conventional media and medicine promote sun avoidance, doing so can actually put your health in grave danger and cause vitamin D deficiency.

The Role of Vitamin D in Disease Prevention

A growing body of evidence shows that vitamin D plays a crucial role in disease prevention and maintaining optimal health. There are about 30,000 genes in your body, and vitamin D affects nearly 3,000 of them, as well as vitamin D receptors located throughout your body.

According to one large-scale study, optimal vitamin D levels can slash your risk of cancer by as much as 60 percent. Keeping your levels optimized can help prevent at least 16 different types of cancer, including pancreatic, lung, ovarian, prostate, and skin cancers. Moreover, vitamin D can build your defenses against cancer by:

- Enhancing the self-destruction of mutated cells (which can replicate and cause cancer)
- Slowing down the production and spread of cancer cells
- Helping in the differentiation of cells (cancer cells are not differentiated)
- Preventing the formation of new blood vessels from pre-existing ones (this can help stop the progress of benign tumors into cancerous ones)

Vitamin D can also help reduce the risk of other conditions as well, including type 2 diabetes, chronic inflammation, age-related macular degeneration (the leading cause of blindness), and Alzheimer's disease.

Vitamin D also exhibits its infection-fighting abilities in the treatment of tuberculosis, pneumonia, colds, and flu. It can also improve seizure control in epileptics. (Mercola.com)

Vitamin E
This is a fat-soluble nutrient found in many foods. In the body, it acts as an antioxidant, helping to protect cells from the damage caused by free radicals. Free radicals are compounds formed when our bodies convert the food we eat into energy.

Vitamin K
Vitamin K is a fat-soluble vitamin that is most well-known for the important role it plays in blood clotting. However, vitamin K is also absolutely essential to building strong bones, preventing heart disease, and a crucial part of other bodily processes. Deficiency can lead to abnormal bleeding. Vitamin K2 should be used in conjunction with D3 for achieving the most optimal levels of Vitamin D without toxicity.

Information came from:
http://www.umm.edu/health/medical/altmed/supplement/coenzyme-q10

GENETIC

MTHFR
The MTHFR gene instructs the body to make an enzyme necessary to convert Vitamin B9 into a usable form. This enzyme is also important in the process of converting homocysteine to methionine – an amino acid the body needs for growth and metabolism. Methylation, a process involving a methyl group activating an enzyme, is also associated with the MTHFR gene. Proper methylation enables the body to detoxify toxic metals, toxins, and other wastes more efficiently. In the case of an MTHFR mutation, an inability to process folic acid (vitamin B9) can have serious effects. For one, a developing fetus can suffer brain defects like spina bifida or anencephaly if the mother has a severe defect in the gene. Folate deficiency can also result in lethargy, impaired cognitive function, and mood disorders.

MTHFR (C677T)
Methylenetetrahydrofolate reductase (MTHFR) is one of the most important enzymes in human physiology. This gene provides your body with instructions to make a protein responsible for folate metabolism. This helps to assess your risk for coronary artery disease and stroke and which medication may be best for you.

Deficiencies in production or function of this enzyme have been associated with increased risk of myocardial infarction, stroke, venous thrombosis, several types of cancer, congenital defects, inflammatory bowel disease, and several neuropsychiatric conditions. In practice, MTHFR function is an important predictor of predispositions to chronic disease states, and interventions aimed at optimizing MTHFR function can often be preventive or therapeutic.

Most research on MTHFR mutations point to the C677T homozygous mutation and how it causes elevated levels of homocysteine. This mutation has been linked to neuropsychiatric conditions due to the indirect effects of MTHFR activity on the production of serotonin, dopamine and norepinephrine, as well as the potentially toxic effect of hyperhomocysteinemia.

Schizophrenia-like syndromes, bipolar disorder, Parkinson's disease, Alzheimer's disease and vascular dementia have all been associated with one or more mutations of the MTHFR gene.

MTHFR (A1298C)
The MTHFR A1298C mutation affects the enzyme methylenetetrahydrofolate reductase by inhibiting the utilization of 5-methyltetrahydrofolate (5-MTHF), or methylfolate, in producing an important chemical called tetrahydrobiopterin, or BH4. BH4 is a cofactor in neurotransmitter production, including serotonin, dopamine, melatonin, epinephrine, and norepinephrine. It also plays a role in the production of nitric oxide. If you have the MTHFR A1298C mutation, you may

be deficient in BH4, which may cause psychological or neurological problems, as well as cardiovascular disease. Methylfolate supplementation can help address the MTHFR A1298C mutation by pushing the production of BH4, thereby preventing or reversing a BH4 deficiency.

PHYSICAL FUNCTIONALITY REPORT

BASIC PHYSICAL

Emotional Stability
This is the strength of your emotions. It is your ability to handle difficulties in your life and to understand and have empathy for others. Emotional stability starts from you, you need to learn to control the way you feel and not let people control it for you.

Glutathione
This is the body's own master antioxidant. It is composed of cysteine, glutamate and glycine. It performs many important roles including:

- Regulation of cell growth and division
- DNA synthesis and repair
- Protein synthesis
- Amino acid transport
- Enzyme catalysis
- Enzyme activation
- Metabolism of toxins
- Metabolism of carcinogens
- Metabolism of xenobiotics
- Conjugation to heavy metals
- Conjugation to xenobiotics
- Enhancement of systemic immune function
- Enhancement of humoral immune function
- Resistance to UV radiation
- Decreases radiation damage
- Decreases free radical damage
- Decreases oxyradical damage
- Metabolizing of hydrogen peroxide (H2O2)
- Recycling of other antioxidants (master antioxidant role)
- Storage and transport of cysteine

- Regulation of homocysteine
- Participation in nutrient metabolism

Hydration
Your body depends on water to survive. Every cell, tissue, and organ in your body needs water to work correctly. For example, your body uses water to maintain its temperature, remove waste, and lubricate joints. Water is needed for good health. Symptoms of dehydration include: little or no urine, or urine that is darker than usual, dry mouth, sleepiness or fatigue, extreme thirst, headache, confusion, dizziness or lightheaded feeling, no tears when crying.

Hypoxia
This is a condition in which the body or a region of the body is deprived of adequate oxygen supply at the tissue level. Symptoms include hot and cold flashes, muscle and mental fatigue, headache, air hunger, nausea, dizziness, euphoria, tingling, visual impairment.

Mental Clarity
The emotional, behavioral, and social maturity or normality; the absence of a mental or behavioral disorder; a state of psychological well-being in which one has achieved a satisfactory integration of one's instinctual drives acceptable to both oneself and one's social milieu; an appropriate balance of love, work, and leisure pursuits.

pH Balance
The term pH is short for the potential of hydrogen. It is a measure of the acidity or alkalinity of our body's fluids and tissues. It is measured on a scale from 0 to 14. The more acidic a solution is, the lower its pH. The more alkaline, the higher the number is.
A pH of 7 is perfectly neutral. The healthiest pH is one that is slightly alkaline. Optimally, we want a pH of 7.365. This number will fluctuate throughout the day, but the normal range is between 6 and 7.5.

Normally, the kidneys maintain our electrolyte levels, those of calcium, magnesium, potassium and sodium. When we are exposed to acidic substances, these electrolytes are used to combat acidity. High degrees of acidity force our bodies to rob minerals from the bones, cells, organs and tissues. Cells end up lacking enough minerals to properly dispose of waste or oxygenate completely. Vitamin absorption is compromised by mineral loss. Toxins and pathogens accumulate in the body and the immune system becomes suppressed.

How Can You Achieve a Proper pH?

Even though there are many sources of acidity and toxicity in our environments, the biggest contributor to unbalanced pH is our diet. Fruits and vegetables contain potassium, a natural buffer to acidity. The western diet contains little in the way of fresh and raw fruits and vegetables. Processed foods contain tons of sodium chloride-table salt-which constricts blood vessels and creates acidity. Eating too much animal protein causes sulfuric acid to build up in

the blood as amino acids are broken down. All grains, whole or not, create acidity in the body. Americans ingest most of their plant food quota in the form of processed corn or wheat.

Our problem is more a matter of not taking in enough alkaline-promoting foods rather than taking in too much acid.

Calcium-rich dairy products cause some of the highest rates of osteoporosis. That's because they create acidity in the body! When your blood stream becomes too acidic, it will steal calcium (a more alkaline substance) from the bones to try to balance out the pH level. So the best way to prevent osteoporosis is to eat lots of alkaline green leafy veggies!

Alkaline Foods including fruits, mushrooms and vegetables (especially citrus, dates, raisins and spinach) promote an alkaline pH. Strangely enough, acidic fruits such as grapefruit and tomatoes don't create acidity in the body. They do just the opposite and contribute to an alkaline environment.

Raw foods-Uncooked fruits and vegetables are said to be biogenic or "life-giving." Cooking foods depletes alkalizing minerals. Increase your intake of raw foods, and try juicing or lightly steaming fruits and vegetables.

Alkaline water has a pH of 9 to 11. Distilled water is just fine to drink. Water filtered with a Reverse Osmosis filter is slightly acidic, but it's still a far better option than tap water or purified bottled water. Adding pH drops, lemon or lime, or baking soda to your water boosts alkalinity.

Green Drinks-Drinks made from green vegetables and grasses in powder form are loaded with alkaline-forming foods and chlorophyll. Chlorophyll is structurally similar to our own blood and alkalizes the blood.

Vagal Tone
The vagus nerve has control over the parasympathetic nervous system, which is called the "rest and digest" nervous system. Not only does it calm and rejuvenate the body, it also antidotes the life-saving, but degenerative "fight or flight" nervous system. If vagal tone is low, this regulation is less effective and inflammation can become excessive. Research shows that a high vagal tone makes your body better at regulating blood glucose levels, reducing the likelihood of diabetes, stroke and cardiovascular disease. Low vagal tone, however, has been associated with chronic inflammation.

BONE AND MUSCLE CONDITION

Adhesions of the Shoulder Muscles

The shoulder capsule thickens, swells, and tightness due to bands of scar tissue (adhesions) that have formed inside the capsule. As a result, there is less room in the joint for the humerus, making movement of the shoulder stiff and painful.

Age of Ligaments (Flexibility/Limberness)
This refers to the absolute range of movement in a joint or series of joints, and length in muscles that cross the joints to induce a bending movement or motion.

Some of the physical changes attributed to aging are the following:

- An increased amount of calcium deposits, adhesions, and cross-links in the body
- An increase in the level of fragmentation and dehydration
- Changes in the chemical structure of the tissues.
- Loss of suppleness due to the replacement of muscle fibers with fatty, collagenous fibers.

When connective tissue is overused, the tissue becomes fatigued and may tear, which also limits flexibility. When connective tissue is unused or under used, it provides significant resistance and limits flexibility. The elastin begins to fray and loses some of its elasticity, and the collagen increases in stiffness and in density. Aging has some of the same effects on connective tissue that lack of use has.

This does not mean that you should give up trying to achieve flexibility if you are old or inflexible. It just means that you need to work harder, and more carefully, for a longer period of time when attempting to increase flexibility. Increases in the ability of muscle tissues and connective tissues to elongate (stretch) can be achieved at any age.

Disc, Protrusion
This is a disease condition which can occur in some vertebrates, including humans, in which the outermost layers of the annulus fibrosus of the intervertebral discs of the spine are intact, but bulge when one or more of the discs are under pressure.

Disc, Degenerative
This is a condition of the discs between vertebrae with loss of cushioning, fragmentation and herniation related to aging. There may be no symptoms. In some cases, the spine loses flexibility and bone spurs may pinch a nerve root, causing pain or weakness.

Joints, Range of Motion
Range of motion (ROM) is a measurement of the distance and direction a joint can move to its full potential. A joint is a location in the body where bones connect. Most of them are constructed to allow movement in predetermined directions.

BONE & GROWTH INDEX

Bone Alkaline Phosphatase
This is the bone-specific isoform of alkaline phosphatase. A glycoprotein that is found on the surface of osteoblasts, BAP reflects the biosynthetic activity of these bone-forming cells. BAP has been shown to be a sensitive and reliable indicator of bone metabolism. Normal bone is constantly undergoing remodeling in which bone degradation or resorption is balanced by bone formation. This process is necessary for maintaining bone health. If the process becomes uncoupled and the rate of resorption exceeds the rate of formation, the resulting bone loss can lead to osteoporosis and, consequently, a higher susceptibility to fractures.

Bone Healing (fracture healing)
This is a proliferative physiological process in which the body facilitates the repair of a bone fracture.Generally bone fracture treatment consists of a doctor reducing (pushing) displaced bones back into place via relocation with or without anesthetic, stabilizing their position to aid union, and then waiting for the bone's natural healing process to occur.Adequate nutrient intake has been found to significantly affect the integrity of the fracture repair. Age, Bone type, drug therapy and pre existing bone pathology are factors which affect healing. The role of bone healing is to produce new bone without a scar as seen in other tissues which would be a structural weakness or deformity. Source

Cartilage Healing
Whether or not cartilage heals on its own depends on your age. Cartilage consists of collagen, the most abundant protein in the body. The collagen matrix of human cartilage becomes essentially permanent sometime in the teen years. After about age 15 or 16 there is no collagen regeneration in the cartilage. Your body, on its own, cannot regenerate the cartilage it loses in its adult years. However, in some cases, damaged cartilage will repair itself with tissue that is not the same; closer to a scar-like tissue. In other cases, the cartilage may heal with higher quality tissue. In any event, allowing healing to take place is better than not having it happen at all. Source

Epiphyseal Line
This is the part of the bone that replaces the epiphyseal growth plate in long bones once a person has reached their full adult height. Either rounded end of a long bone is called an epiphysis, and the shaft of the bone is called the diaphysis. The epiphyseal line is the marking that indicates where the two parts of the bone meet and where the epiphyseal plate was once located in children and young adults. An epiphyseal line is visible on a standard x-ray. It looks like a thin dark streak that stretches horizontally across the rounded ends of the bone. The line may be slightly raised and rougher than the surrounding bone. A person with abnormal bone growth may have a visible crack or an uneven line showing on an x-ray. Formation of this line takes place over many years. When the growth rate slows down after puberty, the cells stop the process of replication and all bone growth eventually stops. Ossification, the hardening of cells

into bone, of the epiphyseal plate occurs when osteoblasts transform the cartilage cells found in the growth plate into bone. Once the entire growth plate is ossified, the epiphyseal line has formed. Source

Osteocalcin
This is the most abundant non-collagenous protein in bone, comprising almost 2% of total protein in the human body. It is important in bone metabolism and is used as a clinical marker for bone turnover, but its precise function remains elusive.
Source

BONE MINERAL DENSITY / DISEASE

Bone Hyperplasia
Hyperplasia is an increase in the amount of organic tissue that results from cell proliferation. In bones it leads to a thickening of the bone which will result in the obstruction of movement in joints, muscles and ligaments. Pain is its main symptom. This pathological hyperplasia can happen on cervical vertebra, lumbar vertebra, joint, calcaneus and so on, including hypertrophic spondylitis, hypertrophic osteoarthropathy, calcaneus spur and so on. Bone hyperplasia can be associated with incorrect posture, age, trauma, and strain.

Bone Mineral Density
BMD, a measure of bone density, reflecting the strength of bones as represented by calcium content. The BMD test detects osteopenia (mild bone loss, usually without symptoms) and osteoporosis (more severe bone loss, which may cause symptoms).

Calcification, Cervical
As people age, the ligaments of the spine can thicken and harden (called calcification). Bones and joints may also enlarge, and bone spurs (called osteophytes) may form. Bulging or herniated discs are also common. Spondylolisthesis (the slipping of one vertebra onto another) also occurs and leads to compression. Calcification of the cervical region is referring to the area of the neck.

Calcification, Lumbar
As people age, the ligaments of the spine can thicken and harden (called calcification). Bones and joints may also enlarge, and bone spurs (called osteophytes) may form. Bulging or herniated discs are also common. Spondylolisthesis (the slipping of one vertebra onto another) also occurs and leads to compression. Calcification of the lumbar region is referring to the area of the lower spine.

Calcification, Sacrum

As people age, the ligaments of the spine can thicken and harden (called calcification). Bones and joints may also enlarge, and bone spurs (called osteophytes) may form. Bulging or herniated discs are also common. The sacroiliac joint connects the sacrum (the triangular bone at the bottom of the lumbar spine) on both sides to the pelvis's ilium. The sacrum and the ilium are connected with a powerful network of ligaments.

The sacroiliac joint is highly susceptible to enthesitis and inflammation because it undergoes significant physical stresses and It has a relatively high concentration of fibrocartilage at the enthuses.

Sacroiliac joint inflammation can cause radiating pain that travels from the buttock to the thigh or lower back. Continued sacroiliiitis and the inflammation-erosion-calcification cycle can eventually lead the bones of the sacroiliac joint to fuse together. While a normal sacroiliac joint has a minimal range of motion measured in just millimeters, sacroiliac joint fusion and immobility can cause pain as well as difficulty with bending forward, backward, and side-to-side.

Calcification, Thoracic
As people age, the ligaments of the spine can thicken and harden (called calcification). Bones and joints may also enlarge, and bone spurs (called osteophytes) may form. Bulging or herniated discs are also common. Spondylolisthesis (the slipping of one vertebra onto another) also occurs and leads to compression. Calcification of the thoracic region refers to the area of the mid back.

Calcium Loss
Calcium deficiency disease, also known as hypocalcemia, increases the risk of developing diseases like osteoporosis. Symptoms of hypocalcemia can include weak hair, nails, memory loss, and seizures.

Osteoclast Function
A type of bone cell that breaks down bone tissue. This function is critical in the maintenance, repair, and remodeling of bones of the vertebral skeleton. The osteoclast disassembles and digests the composite of hydrated protein and mineral at a molecular level by secreting acid and a collagenase, a process known as bone resorption. This process also helps regulate the level of blood calcium.

Osteoporosis
A medical condition in which the bones become brittle and fragile from loss of tissue, typically as a result of hormonal changes, or deficiency of calcium or vitamin D. The body constantly absorbs and replaces bone tissue. With osteoporosis, new bone creation doesn't keep up with old bone removal.

Rheumatism (rheumatic disorder)

This is an umbrella term for conditions causing chronic, often intermittent pain affecting the joints and/or connective tissue. Any disease marked by inflammation and pain in the joints, muscles, or fibrous tissue, especially rheumatoid arthritis. The term “rheumatism”, however, does not designate any specific disorder, but covers at least 200 different conditions.

BRAIN NERVE

Cerebral Arteriosclerosis
This is the result of thickening and hardening of the walls of the arteries in the brain. Symptoms of cerebral arteriosclerosis include headache, facial pain, and impaired vision. If the walls of an artery are too thick, or a blood clot becomes caught in the narrow passage, blood flow to the brain can become blocked and cause an ischemic stroke. When the thickening and hardening is uneven, arterial walls can develop bulges (called aneurysms). If a bulge ruptures, bleeding in the brain can cause a hemorrhagic stroke. Both types of stroke can be fatal.

Cerebral arteriosclerosis is also related to a condition known as vascular dementia, in which small, symptom-free strokes cause cumulative damage and death to neurons (nerve cells) in the brain. Personality changes in the elderly, such as apathy, weeping, transient befuddlement, or irritability, might indicate that cerebral arteriosclerosis is present in the brain. Computer tomography (CT) and magnetic resonance imaging (MRI) of the brain can help reveal the presence of cerebral arteriosclerosis before ischemic strokes, hemorrhagic strokes, or vascular dementia develop.

Cranial Nerves
Spinal nerves emerge sequentially from the spinal cord with the spinal nerve closest to the head (C1) emerging in the space above the first cervical vertebra. The cranial nerves emerge from the central nervous system above this level.
Each cranial nerve is paired and is present on both sides. The numbering of the cranial nerves is based on the order in which they emerge from the brain, front to back (brainstem).

The terminal nerves, olfactory nerves (I) and optic nerves (II) emerge from the cerebrum or forebrain, and the remaining ten pairs arise from the brainstem, which is the lower part of the brain. The cranial nerves are considered components of the peripheral nervous system. However, on a structural level, the olfactory, optic, and terminal nerves are more accurately considered part of the central nervous system.

Cranial Nerve I, Olfactory
This nerve is instrumental for the sense of smell. It is one of the few nerves that are capable of regeneration.

Cranial Nerve II, Optic

This nerve carries visual information from the retina of the eye to the brain.

Cranial Nerve III, Oculomotor
This controls most of the eye's movements, the constriction of the pupil, and maintains an open eyelid.

Cranial Nerve IV, Trochlear
A motor nerve that innervates the superior oblique muscle of the eye, which controls rotational movement.

Cranial Nerve V, Trigeminal
This is responsible for sensation and motor function in the face and mouth.

Cranial Nerve VI, Abducens
A motor nerve that innervates the lateral rectus muscle of the eye, which controls lateral movement.

Cranial Nerve VII, Facial
This controls the muscles of facial expression, and functions in the conveyance of taste sensations from the anterior two-thirds of the tongue and oral cavity.

Cranial Nerve VIII, Vestibulocochlear
This is responsible for transmitting sound and equilibrium (balance) information from the inner ear to the brain.

Cranial Nerve IX, Glossopharyngeal
This nerve receives sensory information from the tonsils, the pharynx, the middle ear, and the rest of the tongue.

Cranial Nerve X, Vagus
The vagus nerve can be thought of as a superhighway that connects your body and your brain. It innervates most organs in the body; the messages zip along its five lanes of traffic with four lanes delivering information from the body to the brain and one lane moving information from the brain to the body. This is the most obvious physical representation of the mind-body connection. The vagus nerve both senses your internal environment (via its sensory neurons) and affects it (via its motor neurons).

Some of the functions of the vagus nerve have been long established, while others were discovered only recently.

Here is what we know about the vagus nerve so far:

1. It is intimately involved in managing sympathetic/parasympathetic balance in the autonomic nervous system (ANS). Here is a quick reminder how ANS works.

The vagus nerve provides 75% of all parasympathetic outflow. When the brain triggers parasympathetic activation, the vagus nerve carries the messages to the heart (decreasing the heart rate and blood pressure), to the lungs (to constrict the respiratory passageways), to every organ in the digestive system (to increase motility and blood flow to the digestive tract, to promote defecation), to the kidneys and bladder (to promote urination) and to reproductive organs (to aid in sexual arousal).

2. It communicates messages between the gut and the brain. 80% of the vagus nerve's fibers (4 out of 5 traffic lanes) deliver information from the enteric nervous system (the second brain in the gut) to the brain.

3. It regulates the muscle movement necessary to keep you breathing. Your brain communicates with your diaphragm via the release of the neurotransmitter acetylcholine from the vagus nerve to keep you breathing. If the vagus nerve stops releasing acetylcholine, you will stop breathing.

4. It helps decrease inflammation. This occurs through the release of the neurotransmitter acetylcholine.

5. It has profound control over heart rate and blood pressure. For example, patients with heart failure, in which the heart fails to pump enough blood through the body, tend to have less active vagus nerves.

6. It helps improve your mood. Research shows that stimulation of the vagus nerve can be an effective treatment for chronic depression that has failed to respond to other treatments.

7. It is essential in fear management. Remember that "gut instinct" that tells you when something isn't right? Turns out that the vagus nerve plays a major role in that. The signals from your gut get sent to the brain via the vagus nerve, and the signals from the brain travel back to the gut, forming a feedback loop. Healthy functioning of the vagus nerve helps us bounce back from stressful situations and overcome fear conditioning.

8. It plays a role in learning and memory. The vagus nerve facilitates learning and re-wiring, so to speak. New findings about the vagus nerve offer exciting possibilities for the treatment of post-traumatic stress disorder (PTSD). Stimulation of the vagus nerve might be able to speed up the process by which people with PTSD can learn to reassociate a non-threatening stimuli which triggers anxiety with a neutral and non-traumatic experience". It can also help with healing sexual stress and trauma.

9. It can help relieve cluster headaches.

Cranial Nerve XI, Spinal Accessory

This nerve controls specific muscles of the shoulder and neck.

Cranial Nerve XII, Hypoglossal Nerve
This nerve controls the tongue movements of speech, food manipulation, and swallowing.

Memory Index (ZS)
This reflects the strength of a person's memory. Cerebral arteriosclerosis, cerebral atrophy and others will lead to insufficient blood supply to the brain. The functional declination of hippocampal cells in the brain is the histological reason for memory decline in the elderly. Memory is divided into two kinds: one is auditory memory and visual memory.

Levels:
If the Memory Index readings are high this may indicate impaired short term memory.
If the Memory Index readings are low this may indicate impaired long term memory.

Parasympathetic Nervous System Function
This (usually abbreviated PSNS, not PNS, to avoid confusion with the peripheral nervous system) is one of the three divisions of the autonomic nervous system, the others being the sympathetic nervous system and enteric nervous system. The autonomic nervous system is responsible for regulating the body's unconscious actions. The parasympathetic system is responsible for stimulation of "rest-and-digest" or "feed and breed" activities that occur when the body is at rest, especially after eating, including sexual arousal, salivation, lacrimation (tears), urination, digestion and defecation. Its action is described as being complementary to that of the sympathetic nervous system, which is responsible for stimulating activities associated with the fight-or-flight response.

Nerve fibers of the parasympathetic nervous system arise from the central nervous system. Specific nerves include several cranial nerves, specifically the oculomotor nerve, facial nerve, glossopharyngeal nerve, and vagus nerve. Three spinal nerves in the sacrum (S2-4), commonly referred to as the pelvic splanchnic nerves, also act as parasympathetic nerves. Because of its location, the parasympathetic system is commonly referred to as having "craniosacral outflow", which stands in contrast to the sympathetic nervous system, which is said to have "thoracolumbar outflow".

Sympathetic Nervous System Function (SNS)
This is one of the two main divisions of the autonomic nervous system, the other being the parasympathetic nervous system (PSNS). The autonomic nervous system functions to regulate the body's unconscious actions. The sympathetic nervous system's primary process is to stimulate the body's fight-or-flight response. It is, however, constantly active at a basic level to maintain homeostasis.

CARDIOVASCULAR / CEREBROVASCULAR

Blood Fat
Blood Lipids (or blood fats) are lipids in the blood, either free or bound to other molecules. They are mostly transported in a protein capsule, and the density of the lipids and type of protein determines the fate of the particle and its influence on metabolism. The concentration of blood lipids depends on intake and excretion from the intestine, and uptake and secretion from cells. Blood lipids are mainly fatty acids and cholesterol. Hyperlipidemia is the presence of elevated or abnormal levels of lipids and /or lipoproteins in the blood, and is a major risk factor for cardiovascular disease.

Blood Viscosity
Blood viscosity is the thickness and stickiness of blood. It is a direct measure of the ability of blood to flow through the vessels. It is also a key screening test that measures how much friction the blood causes against the vessels, how hard the heart has to work to pump blood, and how much oxygen is delivered to organs and tissues. Importantly, high blood viscosity is easily modifiable with safe lifestyle-based interventions.

Brain Tissue Blood Supply Status
Brain Blood Supply; Blood transports oxygen and other nutrients necessary for the health of neurons, so a constant flow of blood to the brain must be maintained. According to Love and Webb, 1992, the brain uses approximately twenty percent of the body's blood and needs twenty-five percent of the body's oxygen supply to function optimally. Blood flow in a healthy person is 54 milliliters per 1000 grams of brain weight per minute. There are 740 milliliters of blood circulating in the brain every minute. 3.3 milliliters of oxygen are used per minute by every 1000 grams of brain tissue. This means that approximately 46 milliliters of oxygen are used by the entire brain in one minute. During sleep, blood flow to the brain is increased, but the rate of oxygen consumption remains the same.

Cerebral Blood Vessel Elasticity
Cerebral Blood Vessel Elasticity; Like a steel cylindrical pipe, an artery consists of an inner space (the "lumen", filled with blood) enclosed by a wall. The wall is made up of a number of layers, two of which are muscle tissue and elastic tissue. When a region of the blood vessel wall weakens, it can balloon out to form a sac-like structure. This structure is called an aneurysm (a word derived from the Greek, aneurysma – widening), and the major problem associated with aneurysms is that they can rupture, an event, which may be fatal.

Cerebral Blood Vessel Resistance
Resistance of blood flow through arterial space.

Cerebrovascular Blood Oxygen Pressure (PaO2)
In the alveoli, the partial pressure of oxygen is around 100 mm Hg and that of carbon dioxide is around 40 mm Hg. In the cells of the body, the PaO2 is closer to 40. The range of normal for

Pa02 is 75 – 100 mm Hg. If your Pa02 is less than this, it means you are not getting enough oxygen.

It is the differences in partial pressure between the capillaries and alveoli that drive oxygen from the alveoli into the capillaries in the lungs, and it is the difference between partial pressures of oxygen in the blood and that in the cells that drives the flow of oxygen from the tissue capillaries into cells. PaO2 is a measure of all the oxygen in the blood – both that which is attached to hemoglobin, and that which is dissolved in the plasma. The majority of oxygen is carried in the blood attached to hemoglobin and only around 1.5% is dissolved in plasma. A low-level of oxygen in the blood is referred to as hypoxemia. When hypoxemia results in a low level of oxygen in tissues it is then referred to as hypoxia. Tissue hypoxia results in tissue damage, and if not corrected, eventually cell death.

Cerebrovascular Blood Oxygen Saturation (Sa)
SaO2 is a measure of how much hemoglobin is occupied by oxygen.

Cerebrovascular Blood Oxygen Volume (CaCO2)
Represents the optimal levels of oxygenation in the blood and exchange of CO2. Low exchange can lead to tissue damage, mental fatigue, and many other complications.

Cholesterol Crystal
Cholesterol Crystals, as cholesterol builds up along the wall of an artery, it crystallizes from a liquid to a solid state and then expands. When the cholesterol crystallizes, two things can happen. If it's a big pool of cholesterol, it will expand, causing the "cap' of the deposit to tear off in the arterial wall. Or the crystals, which are sharp needle-like structures, pole their way through the cap covering the cholesterol deposit. The crystals then work their way into the bloodstream. It is the presence of this material, as well as damage to an artery, that disrupts plaque and puts the body's natural defense mechanism – clotting – into action, which can lead to dangerous, if not fatal clots. Cholesterol in moderation is healthy and necessary for life.

Coronary Artery Elasticity
Coronary Artery Elasticity is also referred to as arteriosclerosis, which is a group of diseases characterized by thickening and loss of elasticity of the arterial walls which progressively blocks the coronary arteries and their branches. Arteriosclerosis is the most common cause of cardiovascular disability and death. Other forms of arteriosclerosis include arteriolosclerosis and medial calcific stenosis, both of which are uncommon in the coronary vasculature.

Coronary Artery Resistance
The coronary vascular resistance is regulated by dynamic changes in vasodilation and vasoconstriction during cardiac cycle. Excess resistance can be caused by build up in the arterial wall as well as blockages.

Coronary Perfusion Pressure

Coronary Perfusion Pressure; the heart is an aerobic organ that is dependent for its oxygen supply entirely on coronary perfusion. Under resting conditions, the myocardium extracts the maximum amount of oxygen from the blood it receives. The O2 saturation of blood returning from the coronary sinus to the right atrium has the lowest saturation of any body organ (30%). Interruption of coronary blood flow will result in immediate ischemia. Coronary blood flow is directly dependent upon perfusion pressure and inversely proportional to the resistance of the coronary vessel. Coronary perfusion occurs in diastole hence diastolic pressure is more important than systolic pressure in determining coronary perfusion. Coronary vessels are divided into epicardial or conductance vessels (R1), pre capillary (R2) and microvascular vessels (R3). The epicardial vessels, the site most commonly affected by atherosclerosis, offer negligible resistance to coronary flow. Resistance to flow occurs in the pre capillary (R2), and microvascular (R3) vessels which are termed resistance vessels. The increased coronary blood flow in response to increased myocardial oxygen demand (MVO2) is achieved by the dilation of these resistance vessels. Three factors play a key role in modifying vascular tone; the accumulation of local metabolites, endothelial factors and neural tone. The accumulation of adenosine during ischemia is an example of local metabolic factors. The most important endothelial substance mediating vasodilation is nitric oxide (NO). Other important mediators are bradykinin, endothelium derived 2 hyperpolarizing factors, and prostacyclin. On the other hand, endothelin-1 (ET-1) is a well-known vasoconstricting substance. Angiotensin II and thromboxane A2 are other well-known endothelium derived constricting factors. Alpha-receptor adrenergic stimulation results in coronary vasoconstriction whereas beta 1 receptor stimulation leads to vasodilatation.

Galectin-3

This protein has been shown to be involved in the following biological processes: cell adhesion, cell activation and chemoattraction, cell growth and differentiation, cell cycle, and apoptosis. Given galectin-3's broad biological functionality, it has been demonstrated to be involved in cancer, inflammation and fibrosis, heart disease, and stroke. have also shown that the expression of galectin-3 is implicated in a variety of processes associated with heart failure, including myofibroblast proliferation, fibrogenesis, tissue repair, inflammation, and ventricular remodeling. Galectin-3 associates with the primary cilium and modulates renal cyst growth in congenital polycystic kidney disease.

Total Peripheral Resistance(TPR)

Resistance to blood flow through arterioles and capillaries. the total resistance to flow of blood in the systemic circuit; the quotient produced by dividing the mean arterial pressure by the cardiac minute-volume.

Left Ventricular Effective Pump Power

The left ventricle is one of four chambers of the heart. It is located in the bottom left portion of the heart below the left atrium, separated by the mitral valve. The thickest of all the chambers, the left ventricle pumps oxygenated blood to tissues all over the body.

The left ventricle pumps oxygenated blood out to the Body to serve the vital needs of every cell of your Body. It pumps most effectively with a pronounced stretching of its muscular wall, which creates an optimal recoil effect (“Starlings’ Effect”). This generates the greatest force with each Ventricular Systole (the contraction of the heart ventricles) and the most effective emptying of the left ventricle.

It is very important for the health of your Left Ventricle to be physically active. The Heart is an Electro-Mechanical Pump. By staying active, you help to optimize the strength of the entire Heart musculature.

This also optimizes blood flow to all the cells of your body, which optimizes the function of all the internal organs, as well as your nervous system and sensoria. Sensorium (plural) are those parts of the brain that receive, process and interpret sensory stimuli.

A sensory stimulus is any event or object that is received by the senses and elicits a response from a person. The stimulus can come in many forms such as light, heat, sound, touch, as well as from internal factors.

Left Ventricular Ejection Impedance
This reflects the indicators of resistance status of the left ventricular outflow channel. Influence Factors: (1) The fact whether the outflow channel has lesion. The aortic stenosis and other conditions can make VER increase. (2) The outflow channel has no lesions, while the emptying rate of aortic blood is slow, so VER is increased. (3) The entire vascular resistance is large.

Myocardial Blood Demand
The heart normally receives 4% of cardiac output, or ~ 250 mL/min of blood. Fatty acids and lactate are the predominant sources of energy, although glucose can be utilized. The myocardium cannot compensate for underperfusion by increasing oxygen extraction significantly (maximal ER is 90%), and thus the only compensatory mechanisms available are to increase blood flow by either changing regional vascular resistance or perfusion pressure.

There are two settings in which myocardial supply and demand can be mismatched – profoundly low perfusion pressures, and irreversible stenosis. In the latter setting, vasodilation of non-critical stenosis vessels can shunt blood away from fixed-diameter vessels, leading to a decrease in coronary blood flow to a susceptible region, a phenomenon known as “coronary steal.”

Myocardial Blood Perfusion Volume
Myocardial Blood Perfusion is the damage to the heart and the risk of future heart damage.

Myocardial Oxygen Consumption

Myocardial Oxygen Balance is determined by the ratio of oxygen supply to oxygen demand. Increasing oxygen supply by increasing either arterial oxygen content or coronary blood flow leads to an increase in tissue oxygen levels (usually measured as the partial pressure of oxygen, pO2). Increasing oxygen demand alone (i.e. myocardial oxygen consumption) decreases tissue oxygen levels. Normally, when oxygen demand increases there is a proportionate increase in coronary blood flow and oxygen supply so that tissue oxygen levels are maintained during times of increased oxygen demand. This increase in blood flow is performed by local regulatory mechanisms. This tight coupling between oxygen demand and coronary blood flow is impaired in coronary artery disease because oxygen supply is limited by vascular stenosis.

NT-proBNP

BNP and NT-proBNP are substances that are produced in the heart and released when the heart is stretched and working hard to pump blood. Heart failure can be confused with other conditions, and it may co-exist with them. BNP and NT-proBNP levels can help doctors differentiate between heart failure and other problems, such as lung disease. An accurate diagnosis is important because the treatments are often different and must be started as soon as possible. Higher-than-normal results suggest that a person has some degree of heart failure, and the level of BNP or NT-proBNP in the blood is related to its severity. Although BNP and NT-proBNP are usually used to recognize heart failure, an increased level in people with acute coronary syndrome (ACS) indicates an increased risk of recurrent events.

Pulse Wave Velocity Coefficient

Arterial stiffness can be assessed noninvasively with the use of pulse wave velocity (PWV) measurement, that is, the velocity of the pulse wave to travel a given distance between 2 sites of the arterial system. Aortic PWV determined from a single measurement is strongly associated with the presence and extent of atherosclerosis and that this measurement is highly related to cardiovascular risk as assessed by the standard Framingham equations.

Stroke Index

A cardiodynamic measure. Stroke volume is the amount of blood the left ventricle ejects in one beat, measured in milliliters per beat (ml/beat). The stroke volume can be indexed to a patient's body size by dividing by the body surface area to yield the stroke index.

Stroke Volume (SV) (Cardiac Stroke Volume)

This is the amount of blood pumped by the left ventricle of the heart in one contraction. The stroke volume is not all of the blood contained in the left ventricle. The heart does not pump all the blood out of the ventricle. Normally, only about two-thirds of the blood in the ventricle is put out with each beat. What blood is actually pumped from the left ventricle is the stroke volume and it, together with the heart rate, determines the cardiac output, the output of blood by the heart per minute. Stroke volume is an important determinant of cardiac output, which is the product of stroke volume and heart rate. Because stroke volume decreases in certain conditions and disease states, stroke volume itself correlates with cardiac function. Assessment

of the cardiac output is important in determining the work that the heart is actually performing with respect to the rest of the cardiovascular system.

Vascular Elasticity

To understand Blood Vessel Elasticity, we first need to understand the anatomy of the vessels. There are three types of vessels – arteries, veins, and capillaries. Arteries, veins, and capillaries are not anatomically the same. They are not just tubes through which blood flows. Both arteries and veins have layers of smooth muscle surrounding them. Arteries have a much thicker layer, and many more elastic fibers as well. The largest artery, the aorta leaving the heart, also has cardiac muscle fibers in its walls for the first few inches of its length immediately leaving the heart. Arteries have to expand to accept the blood being forced into them from the heart, and then squeeze this blood into the veins when the heart relaxes. Arteries have the property of elasticity, meaning that they can expand to accept a volume of blood, then contract and squeeze back to their original size after the pressure is released. A good way to think of them is like a balloon. When you blow into the balloon, it inflates to hold the air. When you release the opening, the balloon squeezes the air back out. It is the elasticity of the arteries that maintains the pressure on the blood when the heart relaxes, and keeps it flowing forward. If the arteries did not have this property, your blood pressure would be more like 120/0, instead of 120/80 that is more normal. Arteries branch into arterioles as they get smaller. Arterioles eventually become capillaries, which are very thin and branching.

Vascular Resistance

Total Peripheral Resistance (TPR) is the sum of the resistance of all peripheral vasculature in the systemic circulation. This should not be confused with Pulmonary Vascular Resistance, which is the resistance in the pulmonary circulation. Vascular resistance is a term used to define the resistance to flow that must be overcome to push blood through the circulatory system. The resistance offered by the peripheral circulation is known as the systemic vascular resistance (SVR), while the resistance offered by the vasculature of the lungs is known as the pulmonary vascular resistance (PVR). The systemic vascular resistance may also be referred to as the total peripheral resistance. Vasoconstriction (i.e., decrease in blood vessel diameter) increases SVR, whereas vasodilation (increase in diameter) decreases SVR.

COLLAGEN INDEX

Collagen is the main structural protein in the extracellular space in the various connective tissues in animal bodies. As the main component of connective tissue, it is the most abundant protein in mammals, making up from 25% to 35% of the whole-body protein content. Depending upon the degree of mineralization, collagen tissues may be rigid (bone), compliant (tendon), or have a gradient from rigid to compliant (cartilage). Collagen, in the form of elongated fibrils, is mostly found in fibrous tissues such as tendons, ligaments and skin. It is also abundant in corneas, cartilage, bones, blood vessels, the gut, intervertebral discs and the dentin in teeth. In muscle tissue, it serves as a major component of the endomysium. Collagen constitutes one to

two percent of muscle tissue, and accounts for 6% of the weight of strong, tendinous muscles. The fibroblast is the most common cell that creates collagen.
Collagen occurs in many places throughout the body. Over 90% of the collagen in the human body, however, is type I.

The five most common types are:

Type I: skin, tendon, vascular ligature, organs, bone (main component of the organic part of bone)
Type II: cartilage (main collagenous component of cartilage)
Type III: reticulate (main component of reticular fibers), commonly found alongside type I
Type IV: forms basal lamina, the epithelium-secreted layer of the basement membrane
Type V: cell surfaces, hair and placenta

Synthesis of collagen requires vitamin C as a cofactor. A long-term deficiency in this vitamin results in impaired collagen synthesis and scurvy. Hydroxylation reactions are catalyzed by two different enzymes: prolyl-4-hydroxylase and lysyl-hydroxylase. Vitamin C also serves with them in inducing these reactions. In this service, one molecule of vitamin C is destroyed for each H replaced by OH. The synthesis of collagen occurs inside and outside of the cell. The formation of collagen which results in fibrillar collagen (most common form) is discussed here. Meshwork collagen, which is often involved in the formation of filtration systems, is the other form of collagen. All types of collagens are triple helices, and the differences lie in the make-up of the alpha peptides created in step 2.

The AO vitals scan looks at collagen in the following areas:

- Bones
- Cartilage
- Eyes
- Hair and Skin
- Ligaments
- Muscles
- Nervous system
- Organs
- Teeth
- Tendons
- Vessels

ENDOCRINE GLANDS

Adrenal Cortex

The outer portion of the adrenal gland is located on top of each kidney. The adrenal cortex produces steroid hormones which regulate carbohydrate and fat metabolism and mineralocorticoid hormones which regulate salt and water balance in the body.

Adrenal Medulla
Rather than releasing a neurotransmitter, the cells of the adrenal medulla secrete hormones. The adrenal medulla consists of irregularly shaped cells grouped around blood vessels. These cells are intimately connected with the sympathetic division of the autonomic nervous system (ANS). In fact, these adrenal medullary cells are modified postganglionic neurons, and preganglionic autonomic nerve fibers lead to them directly from the central nervous system. The adrenal medulla therefore affects available energy, heart rate, and metabolism.

Hypothalamus
The hypothalamus (from Greek ὑπό, “under” and θάλαμος, thalamus) is a portion of the brain that contains a number of small nuclei with a variety of functions. One of the most important functions of the hypothalamus is to link the nervous system to the endocrine system via the pituitary gland (hypophysis).

The hypothalamus is located below the thalamus and is part of the limbic system. In the terminology of neuroanatomy, it forms the ventral part of the diencephalon. All vertebrate brains contain a hypothalamus. In humans, it is the size of an almond.

The hypothalamus is responsible for the regulation of certain metabolic processes and other activities of the autonomic nervous system. It synthesizes and secretes certain neurohormones, called releasing hormones or hypothalamic hormones, and these in turn stimulate or inhibit the secretion of pituitary hormones. The hypothalamus controls body temperature, hunger, important aspects of parenting and attachment behaviors, thirst, fatigue, sleep, and circadian rhythms.

Ovaries
These are organs found in the female reproductive system that produces an ovum. When released, this travels down the fallopian tube into the uterus, where it may become fertilized by a sperm. There is an ovary (from Latin ovarium, meaning egg/nut) found on the left and the right side of the body. The ovaries also secrete hormones that play a role in the menstrual cycle and fertility. The ovary progresses through many stages beginning in the prenatal period through menopause. It is also an endocrine gland because of the various hormones that it secretes.

Testes
The male sex gland, located behind the penis in a pouch of skin called the scrotum. The testes produce and store sperm and are also the body’s main source of male hormones, such as testosterone. These hormones control the development of the reproductive organs and other male characteristics, such as body and facial hair, low voice, and wide shoulders. Also, known as testicles.

Pancreas
It is a glandular organ in the digestive system and endocrine system of vertebrates. In humans, it is located in the abdominal cavity behind the stomach. It is an endocrine gland producing several important hormones, including insulin, glucagon, somatostatin, and pancreatic polypeptide, all of which circulate in the blood. The pancreas is also a digestive organ, secreting pancreatic juice containing bicarbonate to neutralize acidity of chyme moving in from the stomach, as well as digestive enzymes that assist digestion and absorption of nutrients in the small intestine. These enzymes help to further break down the carbohydrates, proteins, and lipids in the chyme. The pancreas is known as a mixed gland.

Parathyroid
They are small endocrine glands in the neck of humans and other tetrapods that produce parathyroid hormone. Humans usually have four parathyroid glands, variably located on the back of the thyroid gland. Parathyroid hormone and calcitonin (one of the hormones made by the thyroid gland) have key roles in regulating the amount of calcium in the blood and within the bones.

Pineal Body
The pineal gland, also known as the pineal body, conarium or epiphysis cerebri, is a small endocrine gland in the vertebrate brain. The pineal gland produces the hormone melatonin, a serotonin derived hormone which modulates sleep patterns in both circadian and seasonal cycles. Melatonin is released into the blood and possibly also into the brain fluid, known as cerebrospinal fluid. The body's daily (circadian) clock controls the production of pineal melatonin, so melatonin is commonly used in human research to understand the body's biological time.

Pituitary, Anterior
The anterior pituitary contains five types of endocrine cell, and they are defined by the hormones they secrete: somatotropes (GH); prolactins (PRL); gonadotropes (LH and FSH); corticotrophs (ACTH) and thyrotropes (TSH). Hormones secreted by the anterior pituitary are trophic hormones and tropic hormones. Trophic hormones directly affect growth either as hyperplasia or hypertrophy on the tissue it is stimulating. Tropic hormones are named for their ability to act directly on target tissues or other endocrine glands to release hormones, causing numerous cascading physiological responses. The anterior pituitary is the glandular, anterior lobe that together with the posterior lobe (posterior pituitary, or the neurohypophysis) makes up the pituitary gland.

Pituitary, Posterior
The posterior lobe of the pituitary gland which is part of the endocrine system. The posterior pituitary secretes the hormone oxytocin which increases uterine contractions and antidiuretic hormone (ADH) which increases reabsorption of water by the tubules of the kidney. Underproduction of ADH results in a disorder called diabetes insipidus characterized by inability to concentrate the urine and, consequently, excess urination leading potentially to dehydration. The urine is "insipid" (overly dilute).

Thyroid
Thyroid hormone (Triiodothyronine or T3) regulates our metabolic rate and is associated with modest changes in body weight and energy levels. it is an endocrine gland located in the front of our necks. It stores and produces hormones that affect the function of virtually every organ in our bodies. It plays a major role in the metabolism, growth and maturation of the human body. It helps to regulate many body functions by constantly releasing a steady amount of hormones into the bloodstream. More hormones are produced when the body needs more energy, like when it is growing or cold, or during pregnancy.

Uterus
The uterus has three layers: the inner lining (endometrium); the middle muscular layer (myometrium); and the outer layer (perimetrium). The uterus is connected to the fallopian tubes, the cervix, and (via the cervix) the vagina. The main purpose of the uterus is to nourish a fetus prior to birth.

Prostate
It is a compound tubuloalveolar exocrine gland of the male reproductive system in most mammals.

EYE HEALTH

Bags Under the Eyes
As you age, the tissue structures and muscles supporting your eyelids weaken. The skin may start to sag, and fat that is normally confined to the area around the eye (orbit) can move into the area below your eyes. Also, the space below your eyes can accumulate fluid, making the under-eye area appear puffy or swollen. Several factors can lead to this, including:
Fluid retention due to changes in weather (for example, hot, humid days), hormone levels or eating salty foods

Not getting enough sleep
Allergies or dermatitis, especially if puffiness is accompanied by redness and itching
Heredity – under-eye bags can run in families

Dark Circles
Dark circles have a variety of different causes. And despite what some people think, fatigue isn't one of them. Besides alcohol and lack of sleep, illnesses also cause these circles to appear. The combination of a fair complexion and thin skin is often the culprit.

Some of the more common causes of dark circles under the eyes include:
Heredity. Dark circles under the eyes can appear in childhood, and are often an inherited trait. Some children will outgrow them, but others will not.

Allergies. Nasal congestion can dilate the blood vessels that drain from the area around your eyes, causing them to darken.

Sleep deprivation is the most common cause, and the easiest to prevent, but …
Oversleeping can also cause dark eye circles.

Eczema

Stress

Age. As we get older, our skin becomes thinner.

Iron deficiency can prevent the blood from carrying sufficient oxygen to eye tissues.

Minor trauma that causes the appearance of a black eye.

Additional causes for dark circles under your eyes:
Crying

Lifestyle. Excessive smoking or drinking can contribute to under-eye circles. Also, people who drink too much coffee or who use cocaine or amphetamines may have difficulty getting enough sleep.

Fluid retention, as may occur with pregnancy or weight gain.

Skin pigmentation abnormalities. The skin around the eyes is thinner, which is why your blood vessels are more readily visible through it.

Excessive exposure to the sun. Sun exposure encourages your body to produce more melanin.

Age. As we get older, we lose some of the fat and collagen surrounding our eyes. This loss, combined with the thinning of our skin, magnifies the appearance of dark eye circles.

Mononucleosis can cause the eyes to appear puffy and swollen. This is due partly to the fatigue that people feel when they are suffering from it, and partly because this illness causes a yellowing of the eyes and the skin around them (this is called jaundice).

Periorbital cellulitis. This is a bacterial infection of the eyelid or eyelids. If it is promptly treated with antibiotics, however, it is nothing to worry about.

Excess salt in the diet causes fluid retention throughout your body-including underneath your eyes.

Edema

Edema is swelling caused by excess fluid trapped in your body's tissues. Edema is the medical term for swelling. Body parts swell from injury or inflammation. It can affect a small area or the entire body. Medications, infections, pregnancy, and many other medical problems can cause edema.

Edema happens when your small blood vessels become "leaky" and release fluid into nearby tissues. That extra fluid builds up, which makes the tissue swell.
Causes of edema things like a twisted ankle, a bee sting, or a skin infection will cause edema. In some cases, like an infection, this may be helpful. More fluid from your blood vessels puts more infection-fighting white blood cells in the swollen area. Even though edema affects all parts of your body, it's most common on the hands, arms, feet, ankles and legs.

Eye Cell Activity

Lack of blood flow in the interior part of the eye makes it more vulnerable compared with other organs even in the case of weak thermal interactions. Protecting your eyes from winter elements like low temperatures, wind, and even the sun is essential to your ocular health.

Low body temperature causes dry eyes and other vision problems like blurred vision.

The cold can irritate your eyes and make them start to water. If it's very cold, your eyelashes may freeze together. In severe conditions, your corneas can also freeze without the proper protection. Wind can predispose your eyes to pterygium growths. These are fleshy bumps that grow on the whites of your eyes like little calluses. They're more common in people who spend time outdoors, so if you do a lot of skiing or other winter sports make sure you wear eye protection.
Reduced temperature will also slow the metabolism of cells and after a long period of time results in cell death.

Ultraviolet (UV) rays from the sun can damage your eyes in a number of ways, including contributing to cataracts and macular degeneration. High temperatures will also lead to eye cell death.

If your Eye Cell Activity reading is higher than 0.892, this may indicate a mild cellular reaction to abnormal body temperature. If you're reading is higher than 1.37 this may indicate a moderate cellular condition to temperature and if you're reading if higher than 1.892 this indicates a severe reaction to body temperature or eye temperature variance to normal. If your Eye Cell Activity reading is lower than 0.118, this is generally of no concern.

Lymphatic Obstruction

Also known as lymphedema is a condition that results from impaired flow of the lymphatic system. It's an abnormal collection of high-protein fluid just beneath the skin. This swelling, or edema, occurs most commonly in the arm or leg, but it also may occur in other parts of the body including the breast or trunk, head and neck, or genitals. Lymphedema usually develops when lymph vessels are damaged or lymph nodes are removed (secondary lymphedema) but can also be present when lymphatic vessels are missing or impaired due to a hereditary condition (primary lymphedema).

Lymphatic fluid is normally transported out of a region of the body by an extensive network of lymph vessels. When the collection of protein-rich fluid persists in a specific area, it can attract more fluid and thus worsen the swelling. In addition to increased fluid in the area, the body experiences an inflammatory reaction resulting in scar tissue called fibrosis in the affected area. The presence of fibrosis makes it even more difficult for the excess fluid to be eliminated from the area. As a result, the increased fluid and fibrosis prevents the delivery of oxygen and essential nutrients to the area, which in turn can delay wound healing, provide a culture medium for bacteria to grow, and increase the risk of infections in or below the skin called cellulitis or lymphangitis.

Sagging

Skin sags with age primarily due to loss of volume in the underlying structures, such as soft tissue, fat and bone. The most common cause of sagging skin is aging. As you age, your skin loses its collagen and elastin in the dermis due to ultraviolet light., your skin's supportive connective tissue, that makes it look soft, plump and youthful. In addition, facial muscles can weaken with age, which takes a toll too. Getting older means more exposure to the dreaded pull of gravity; which we know causes skin to sag a little further down with each passing day.

Sun exposure is another reason for skin losing its elasticity. The sun's powerful rays damage skin cells which, over time, can increase the effects of aging.
Loss of large amounts of weight over a short period of time, can cause skin to sag. Those who undergo bariatric surgery often find themselves stuck with skin and tissue too stretched out to snap back.

Visual Fatigue

"Visual fatigue" provides a label for conditions experienced by individuals whose work involves extended visual concentration. It describes phenomena related to intensive use of the eyes. It can include complaints of eye or periocular pain, itching or burning, tearing, oculomotor changes, focal problems, performance degradation, "after colors," and other phenomena. "Asthenopia," another term for visual fatigue, is characterized by pain, discomfort, or fatigue in and around the eyes. The term in its current usage is equivalent to that of visual fatigue.

Visual fatigue results from visual inefficiencies or from eye-related symptoms caused by a combination of individual visual abnormalities and poor visual ergonomics. The problems (whether computer-related or not) occur whenever the visual demands of the task exceed the

abilities of the individual. Symptoms of visual fatigue usually resolve with a combination of changes in the environment and appropriate visual care.

Information from these Sites:

http://www.mayoclinic.org/diseases-conditions/bags-under-eyes/basics/treatment/con-20034185)
http://www.eyehealthweb.com/dark-circles-under-eyes/)
http://www.webmd.com/heart-disease/heart-failure/edema-overview#1
http://diamarousa.com/eye-cell-activity/
http://www.lymphnet.org/le-faqs/what-is-lymphedema
http://health.howstuffworks.com/skin-care/problems/beauty/sagging-skin1.htm
http://www.mdguidelines.com/visual-fatigue

HORMONES: MOOD / SEX / SLEEP / STRESS

Cortisol

Cortisol is a steroid hormone, in the glucocorticoid class of hormones. When used as a medication, it is known as hydrocortisone. It is produced in humans by the zona fasciculata of the adrenal cortex within the adrenal gland. It is released in response to stress and low blood-glucose concentration. It functions to increase blood sugar through gluconeogenesis, to suppress the immune system, and to aid in the metabolism of fat, protein, and carbohydrates. It also decreases bone formation.

Dehydroepiandrosterone (DHEA)

Also, known as androstenolone, is an endogenous steroid hormone. It is the most abundant circulating steroid hormone in humans, in whom it is produced in the adrenal glands, the gonads, and the brain, where it functions predominantly as a metabolic intermediate in the biosynthesis of the androgen and estrogen sex steroids. However, DHEA also has a variety of potential biological effects in its own right, binding to an array of nuclear and cell surface receptors, and acting as a neurosteroid.

Epinephrine

Also, known as adrenalin or adrenaline, is a hormone, neurotransmitter and medication. Epinephrine is normally produced by both the adrenal glands and certain neurons. It plays an important role in the fight-or-flight response by increasing blood flow to muscles, output of the heart, pupil dilation, and blood sugar. It does this by its effects on alpha and beta receptors. It is found in many animals and some cell organisms.

Estradiol (E2)

It is also spelled estradiol, is a steroid, an estrogen, and the primary female sex hormone. It is named for and is important in the regulation of the estrous and menstrual female reproductive

cycles. Estradiol is essential for the development and maintenance of female reproductive tissues such as the breasts, uterus, and vagina during puberty, adulthood, and pregnancy, but it also has important effects in many other tissues including bone, fat, skin, liver, and the brain. While estrogen levels in men are lower compared to women, estrogens have essential functions in men as well.

Estrogen
Is the primary female sex hormone as well as a medication. It is responsible for the development and regulation of the female reproductive system and secondary sex characteristics. Estrogen may also refer to any substance, natural or synthetic, that mimics the effects of the natural hormone. The estrane steroid estradiol is the most potent and prevalent endogenous estrogen, although several metabolites of estradiol also have estrogenic hormonal activity. Estrogens are used as medications as part of some oral contraceptives, in hormone replacement therapy for postmenopausal, hypogonadal, and transgender women, and in the treatment of certain hormone-sensitive cancers like prostate cancer and breast cancer.

Estriol
It is a relatively weak natural estrogenic hormone that is a glycol C18 H24 O3 found in the body chiefly as a metabolite of estradiol, is the main estrogen secreted by the placenta during pregnancy, and is the estrogen typically found in the urine of pregnant women. Estriol is produced in notable quantities only during pregnancy. Levels of estriol increase 1,000-fold during pregnancy, whereas levels of estradiol and estrone increase 100-fold, and estriol accounts for 90% of the estrogens in the urine of pregnant women. At term, the daily production of estriol by the placenta is 35 to 45 mg, and levels in the maternal circulation are 8 to 13 ng/dL

Follicle Stimulating Hormone (FSH)
This is a hormone produced by the anterior lobe of the pituitary gland that stimulates the growth of the ovum-containing follicles in the ovary and activates sperm-forming cells.

GABA
Gonadotropin; are glycoprotein polypeptide hormones secreted by gonadotrope cells of the anterior pituitary of vertebrates. This family includes the mammalian hormones follicle-stimulating hormone (FSH), luteinizing hormone (LH), and placental/chorionic gonadotropins human chorionic gonadotropin (hCG) and equine chorionic gonadotropin (eCG), as well as at least two forms of fish gonadotropins. These hormones are central to the complex endocrine system that regulates normal growth, sexual development, and reproductive function. LH and FSH are secreted by the anterior pituitary gland, while hCG and eCG are secreted by the placenta in pregnant humans and mares, respectively. The gonadotropins act on the gonads, controlling gamete and sex hormone production.

Human Growth Hormone (HGH)
This is a peptide hormone that stimulates growth, cell reproduction, and cell regeneration in humans and other animals. It is thus important in human development. It is a type of mitogen which is specific only to certain kinds of cells. Growth hormone is a 191-amino acid, single-chain

polypeptide that is synthesized, stored and secreted by somatotropic cells within the lateral wings of the anterior pituitary gland.

Human Sex Hormone-Binding Globulin
This is a glycoprotein that binds to the two sex hormones: androgen and estrogen.

Insulin-Like Growth Factor 1 (IGF-1)
This is a protein that in humans is encoded by the IGF1 gene. IGF-1 has also been referred to as a “sulfation factor” and its effects were termed “non suppressible insulin-like activity” (NSILA) in the 1970s.

> IGF-1 is a hormone similar in molecular structure to insulin. It plays an important role in childhood growth and continues to have anabolic effects in adults. A synthetic analog of IGF-1, mecasermin, is used for the treatment of growth failure.
>
> IGF-1 consists of 70 amino acids in a single chain with three intramolecular disulfide bridges. IGF-1 has a molecular weight of 7,649 Daltons.

Luteinizing Hormone (LH)
Luteinizing hormone (LH) is produced and released in the anterior pituitary gland. This hormone is considered a gonadotropic hormone because of its role in controlling the function of ovaries in females and testes in males, which are known as the gonads.

Melatonin
This is a vertebrate hormone C13 H16 N2 O2 that is derived from serotonin, is secreted by the pineal gland especially in response to darkness, and has been linked to the regulation of circadian rhythms. Melatonin is a hormone made by the pineal gland, a small gland in the brain. Melatonin helps control your sleep and wake cycles.

Norepinephrine
This is a hormone that is released by the adrenal medulla and by the sympathetic nerves and functions as a neurotransmitter. It is also used as a drug to raise blood pressure. In the brain, norepinephrine is produced in closely packed brain cell neurons or nuclei that are small yet exert powerful effects on other brain areas. The most important of these nuclei is the locus coeruleus, located in the pons. Outside the brain, norepinephrine is used as a neurotransmitter by sympathetic ganglia located near the spinal cord or in the abdomen, and it is also released directly into the bloodstream by the adrenal glands. Regardless of how and where it is released, norepinephrine acts on target cells by binding to and activating noradrenergic receptors located on the cell surface. The general function of norepinephrine is to mobilize the brain and body for action. Norepinephrine release is lowest during sleep, rises during wakefulness, and reaches much higher levels during situations of stress or danger, in the so-called fight-or-flight response. norepinephrine increases arousal and alertness, promotes vigilance, enhances formation and retrieval of memory, and focuses attention; it also increases restlessness and anxiety.

Progesterone
This is a steroid sex hormone that is the principal progestational agent; it plays a major part in the menstrual cycle. During the maturation of the secondary oocyte (ovum), estrogen, the principal female sex hormone, is produced at a high rate. At ovulation estrogen production is sharply reduced, and the ovary then creates within itself a special endocrine structure called the corpus luteum whose sole function is to produce progesterone. Unless fertilization takes place, the corpus luteum disappears when it has performed its function. The progesterone it has produced is promptly carried by the blood to the uterus, as was the estrogen previously. Both hormones now work to prepare the uterus for possible conception. In pregnancy progesterone acts in a way that protects the embryo and fosters growth of the placenta. By decreasing the frequency of uterine contractions it helps to prevent expulsion of the implanted zygote. It also promotes secretory changes in the mucosa of the fallopian tubes, thereby helping to provide nutrition for the fertilized ovum as it travels through the tube on its way to the uterus.

Prolactin
Prolactin is a hormone whose primary function is helping women produce milk after childbirth. It is produced and secreted into the bloodstream by the anterior pituitary gland. Prolactin stimulates the development and growth of the mammary glands after the glands have been prepared by estrogen, progesterone, thyroxine, insulin, growth hormone, glucocorticoids, and human placental lactogen. After parturition, prolactin, together with glucocorticoids, is essential for the initiation and maintenance of milk production. Prolactin synthesis and release from the pituitary are mediated by the central nervous system in response to suckling by the infant. When suckling or its mechanical equivalent ceases, prolactin secretion slows and milk production ceases. Prolactin has no known function in human males.

Serotonin
Serotonin impacts every part of your body, from your emotions to your motor skills. Serotonin is considered a natural mood stabilizer and the chemical that helps sleeping, eating, and digesting. Serotonin also helps reduce depression, regulate anxiety, heal wounds, stimulate nausea, and maintain bone health. Serotonin is part of the reason why you become nauseous. Production of serotonin rises to push out noxious or upsetting food quicker in diarrhea. The chemical also increases in the blood, which stimulates the part of the brain that controls nausea. This chemical is responsible for stimulating the parts of the brain that control sleep and waking.

Testosterone
Testosterone is produced in the ovaries in women, the testes in men, and the adrenal glands in both genders. It is an androgen, or a hormone that stimulates the development of male characteristics. While men have it in higher amounts, men and women have testosterone to some extent. Testosterone is the hormone that initiates the internal and external development of a male fetus, including the reproductive organs. It plays an important role during male puberty, sparking growth spurts, hair growth and genital changes.

Testosterone-Free

Most of the testosterone in your blood attaches to two proteins: albumin and sex hormone binding globulin (SHBG). Free Testosterone is a test that measures the amount of unattached, or “free,” testosterone in your blood.

IMMUNE SYSTEM

Adenoids and Tonsils
Adenoids are made of similar tissue and are part of the immune system. Like tonsils, adenoids help to defend the body from infection. They trap bacteria and viruses which you breathe in through your nose. They contain cells and antibodies of the immune system to help prevent throat and lung infections.

Appendix
The appendix is near the junction of the small intestine and the large intestine and has abundant infection-fighting lymphoid cells, which suggests it plays a role in the immune system. Normally, the appendix sits in the lower right abdomen, but the actual function of the appendix is unknown.

Bone Marrow
Bone marrow is the spongy tissue inside some of your bones. It contains stem cells. The stem cells can develop into the red blood cells that carry oxygen through your body, the white blood cells that fight infections, and the platelets that help with blood clotting.

Immunoglobulin A (IgA)
An immunoglobulin test measures the level of certain immunoglobulins, or antibodies, in the blood. Antibodies are proteins made by the immune system to fight antigens, such as bacteria, viruses, and toxins. Selective IgA Deficiency is one of the most common primary immunodeficiency diseases. as many as one in every 500 Caucasian people has Selective IgA Deficiency. it is not understood why some individuals with IgA deficiency have almost no illness while others are very sick. A common problem in Selective IgA Deficiency is susceptibility to infections. This is seen in about half of the patients with IgA deficiency that come to medical attention. Recurrent ear infections, sinusitis, bronchitis and pneumonia are the most common infections seen in patients with Selective IgA Deficiency. A second major problem in IgA deficiency is the occurrence of autoimmune diseases. These are found in about 25% to 33% of patients who seek medical help. In autoimmune diseases, individuals produce antibodies or T-lymphocytes, which react with their own tissues with resulting inflammation and damage. The diagnosis of Selective IgA Deficiency is usually suspected because of chronic or recurrent infections, autoimmune diseases, chronic diarrhea or some combination of these problems.

Immunoglobulin D (IgD)

This is a monomeric antibody isotype that is expressed in the plasma membranes of immature B-lymphocytes. IgD is also produced in a secreted form that is found in small amounts in blood serum. Secreted IgD is made up of two heavy chains of the delta class, and two light chains. IgD's function is to signal the B cells to be activated. By being activated, they are ready to take part in the defense of the body in the immune system. During B-cell differentiation, IgM is the exclusive isotype expressed by immature B cells. IgD starts to be expressed when the B-cell exits the bone marrow to populate peripheral lymphoid tissues. When a B-cell reaches its mature state, it co-expresses both IgM and IgD.

Immunoglobulin E (IgE)
This is one of the five subclasses of antibodies. Antibodies are proteins made by the immune system that attack antigens, such as bacteria, viruses, and allergens. IgE antibodies are found in the lungs, skin, and mucous membranes. IgE's main function is immunity to parasites such as helminths like Schistosoma mansoni, Trichinella spiralis, and Fasciola hepatica. IgE is utilized during immune defense against certain protozoan parasites such as Plasmodium falciparum. IgE food allergies cause the release of histamine, producing an immediate hypersensitivity reaction, in which symptoms appear within minutes or hours. Prick skin tests can be used to identify specific IgE sensitization.

Immunoglobulin G (IgG)
This is a type of antibody. Each IgG has two antigen binding sites. Representing approximately 75% of serum antibodies in humans, IgG is the most common type of antibody found in the circulation. IgG molecules are created and released by plasma B cells. Antibodies are major components of humoral immunity. IgG is the main type of antibody found in blood and extracellular fluid allowing it to control infection of body tissues. By binding many kinds of pathogens such as viruses, bacteria, and fungi, IgG protects the body from infection. IgG (immunoglobulin G) testing is a useful guide for structuring elimination diets in many chronic conditions. Individuals with neurological, gastrointestinal, and movement disorders often suffer from IgG food allergies. These people may continue to eat offending foods unaware of their potential effects.

THE BENEFITS OF TESTING

Helps determine if food reactions are contributing to physical or mental symptoms.

Removal of highly reactive foods from the diet is a non-invasive, food-based therapy that often mitigates a patient's symptoms.

Research and clinical studies suggest food allergies identified by IgG testing can be a major contributing factor in many chronic health conditions.

Food rotation and elimination diets can reduce stress on the immune system, lower gut inflammation, resolve food cravings, and reduce the potential for eating disorders.

Immunoglobulin M (IgM)
This is a basic antibody that is produced by B cells. IgM is by far the physically largest antibody in the human circulatory system. It is the first antibody to appear in response to initial exposure to an antigen. IgM is a polymer, where multiple immunoglobulins are linked together by strong covalent bonds known as disulfide bonds.

Liver
The liver is a large, meaty organ that sits on the right side of the belly. The liver also detoxifies chemicals and metabolizes drugs. As it does so, the liver secretes bile that ends up back in the intestines. The liver also makes proteins important for blood clotting and other functions.

Lymph Nodes
Lymph nodes are small, bean-shaped glands throughout the body. They are part of the lymph system, which carries fluid (lymph fluid), nutrients, and waste material between the body tissues and the bloodstream. The lymph system is an important part of the immune system, the body's defense system against disease.

Lymphatic Vessels (Lymph Vessels/Lymphatics)
These are thin-walled, valved structures that carry lymph. As part of the lymphatic system, lymph vessels are complementary to the cardiovascular system. Lymph vessels are lined by endothelial cells, and have a thin layer of smooth muscles, and adventitia that bind the lymph vessels to the surrounding tissue. Lymph vessels are devoted to propulsion of the lymph from the lymph capillaries, which are mainly concerned with absorption of interstitial fluid from the tissues. Lymphatic capillaries are designed to pick up the fluid that leaks into your tissues from your bloodstream and return it to your circulatory system.

Mucosa
This is a membrane that lines various cavities in the body and surrounds internal organs. It consists of one or more layers of epithelial cells overlying a layer of loose connective tissue. It has to do with a mucous membrane. For example, the oral mucosa.

Peyer's Patches
They are organized lymphoid follicles, named after the 17th-century Swiss anatomist Johann Conrad Peyer. They are an important part of gut associated lymphoid tissue usually found in humans in the lowest portion of the small intestine. Because the lumen of the gastrointestinal tract is exposed to the external environment, much of it is populated with potentially pathogenic microorganisms. Peyer's patches thus establish their importance in the immune surveillance of the intestinal lumen and in facilitating the generation of the immune response within the mucosa. Pathogenic microorganisms and other antigens entering the intestinal tract encounter macrophages, dendritic cells, B-lymphocytes, and T-lymphocytes found in Peyer's patches and other sites of gut-associated lymphoid tissue (GALT). Peyer's patches thus act for the gastrointestinal system much as the tonsils act for the respiratory system, trapping foreign particles, surveilling them, and destroying them.

Spleen
The spleen is the largest lymphatic organ in the body. The spleen also filters blood, serves as a major reservoir for blood, and destroys blood cells that are aged.

Thymus
The thymus, despite containing glandular tissue and producing several hormones, is much more closely associated with the immune system than with the endocrine system. The thymus serves a vital role in the training and development of T-lymphocytes or T cells, an extremely important type of white blood cell. T cells defend the body from potentially deadly pathogens such as bacteria, viruses, and fungi. The function of the thymus is to receive immature T cells that are produced in the red bone marrow and train them into functional, mature T cells that attack only foreign cells. T cells first reside within the cortex of the thymus where they come in contact with epithelial cells presenting various antigens. The immature T cells that respond to the antigens corresponding to foreign cells are selected to survive, mature, and migrate to the medulla while the rest die via apoptosis and are cleaned up by macrophages. This process is known as positive selection.

KIDNEY FUNCTION

Blood Urea Nitrogen (BUN)
This is an indicator of kidney function. Urea is a metabolic byproduct which can build up if kidney function is impaired. The BUN-to-creatinine ratio generally provides more precise information about kidney function and its possible underlying cause compared with creatinine level alone. BUN also increases with dehydration.

Creatinine, Serum (mg/dL)
Creatinine has been found to be a fairly reliable indicator of kidney function. Elevated creatinine level signifies impaired kidney function or kidney disease. As the kidneys become impaired for any reason, the creatinine level in the blood will rise due to poor clearance of creatinine by the kidneys. Abnormally high levels of creatinine thus warn of possible malfunction or failure of the kidneys. It is for this reason that standard blood tests routinely check the amount of creatinine in the blood.

Cystatin C
This is used as a biomarker of kidney function. High levels indicate a decline in kidney function.

Proteinuria
Urine contains an abnormal amount of protein. The condition is often a sign of kidney disease. Healthy kidneys do not allow a significant amount of protein to pass through their filters. But filters damaged by kidney disease may let proteins such as albumin leak from the blood into the urine. The two most common risk factors for proteinuria are diabetes and high blood pressure.

Uric Acid
The uric acid blood test is used to detect high levels of this compound in the blood in order to help diagnose gout. The test is also used to monitor uric acid levels in people undergoing chemotherapy or radiation treatment for cancer. Rapid cell turnover from such treatment can result in an increased uric acid level. The uric acid urine test is used to help diagnose the cause of recurrent kidney stones and to monitor people with gout for stone formation.

Urobilinogen
This is a colorless by-product of bilirubin reduction. It is formed in the intestines by bacterial action on bilirubin. About half of the urobilinogen formed is reabsorbed and taken up via the portal vein to the liver, enters circulation and is excreted by the kidney. Low urine urobilinogen may result from complete obstructive jaundice or treatment with broad-spectrum antibiotics, which destroy the intestinal bacterial flora. (Obstruction of bilirubin passage into the gut or failure of urobilinogen production in the gut.) Low urine urobilinogen levels may result from congenital enzymatic jaundice (hyperbilirubinemia syndromes) or from treatment with drugs that acidify urine, such as ammonium chloride or ascorbic acid. Elevated levels may indicate hemolytic anemia (excessive breakdown of red blood cells RBC), overburdening of the liver, increased urobilinogen production, re-absorption – a large hematoma, restricted liver function, hepatic infection, poisoning or liver cirrhosis.

LIVER AND GALLBLADDER FUNCTION

ALP
The alkaline phosphatase test (ALP) is used to help detect liver disease or bone disorders. In conditions affecting the liver, damaged liver cells release increased amounts of ALP into the blood.

Higher-than-normal ALP levels can indicate: biliary obstruction, bone conditions, osteoblastic bone tumors, osteomalacia (a fracture that is healing), liver disease or hepatitis, eating a fatty meal if you have blood type o or b, hyperparathyroidism, leukemia, lymphoma, paget disease, rickets, sarcoidosis.

Lower-than-normal ALP levels: hypophosphatasia, malnutrition, protein deficiency, or Wilson disease.

Other conditions for which the test may be done include: alcoholic liver disease (hepatitis/cirrhosis), alcoholism, biliary stricture, gallstones, giant cell (temporal, cranial) arteritis, multiple endocrine neoplasia (men) ii, pancreatitis, renal cell carcinoma.

ALT (Alanine Aminotransferase)
This is present primarily in liver cells. In viral hepatitis and other forms of liver disease associated with hepatic necrosis, serum ALT is elevated even before the clinical signs and

symptoms of the disease appear. Although serum levels of both aspartate aminotransferase (AST) and ALT become elevated whenever disease processes affect liver cell integrity, ALT is a more liver-specific enzyme. Serum elevations of ALT are rarely observed in conditions other than parenchymal liver.

Moreover, the elevation of ALT activity persists longer than does AST activity. Elevated alanine aminotransferase (ALT) values are seen in parenchymal liver diseases characterized by a destruction of hepatocytes. Values are typically at least ten times above the normal range. Levels may reach values as high as one hundred times the upper reference limit, although twenty to fifty-fold elevations are most frequently encountered. In infectious hepatitis and other inflammatory conditions affecting the liver, ALT is characteristically as high as or higher than aspartate aminotransferase (AST), and the ALT/AST ratio, which normally and in other conditions is <1, becomes greater than unity. ALT levels are usually elevated before clinical signs and symptoms of disease appear.

AST (Aspartate Aminotransferase)
A test measures the amount of this enzyme in the blood. AST is normally found in red blood cells, liver, heart, muscle tissue, pancreas, and kidneys. Low levels of AST are normally found in the blood. When body tissue or an organ such as the heart or liver is diseased or damaged, additional AST is released into the bloodstream. The amount of AST in the blood is directly related to the extent of the tissue damage. After severe damage, AST levels rise in 6 to 10 hours and remain high for about 4 days.

The AST test may be done at the same time as a test for alanine aminotransferase, or ALT. The ratio of AST to ALT sometimes can help determine whether the liver or another organ has been damaged. Both ALT and AST levels can test for liver damage.

An aspartate aminotransferase (AST) test is done to: Check for liver damage, Help identify liver disease, such as hepatitis (liver disease may produce symptoms such as pain in the upper abdomen, nausea, vomiting, and sometimes jaundice). Check on the success of treatment for liver disease, find out whether jaundice was caused by a blood disorder or liver disease, and keep track of the effects of medicines that can damage the liver.

Bile Secretion Function
Bile is a digestive juice that is secreted by the liver and stored in the gallbladder. Bile does not contain enzymes like other secretions from the gastrointestinal tract. Instead it has bile salts (acids) which can emulsify fat and break it down into small particles with its detergent-like action. And then help the body absorb these broken-down products of fat in the gut. Bile salts bind with lipids to form micelles. This is then absorbed through the intestinal mucosa. The other important function of bile is that it contains waste products from hemoglobin breakdown. This is known as bilirubin and is normally formed by the body as it gets rid of old red blood cells which are rich in hemoglobin. Bile also carries excess cholesterol out of the body and ‘dumps’ it into the gastrointestinal tract where it can be passed out with other waste matter.

The liver cells (hepatocytes) produce bile which collects and drains into the hepatic duct. From here it can enter the small intestine to act on fats by traveling down the common bile duct, or it can enter the gallbladder through the cystic duct, where it is stored.

The liver manufactures between 600ml to 1 liter of bile in a day. As bile travels down the ducts, the lining of these passages secrete water, sodium and bicarbonate ions into the bile, thereby diluting it. These additional substances help to neutralize the stomach acid which enters the duodenum with partially digested food (chyme) from the stomach.

Bilirubin

A bilirubin test is used to detect an increased level in the blood. It may be used to help determine the cause of jaundice and/or help diagnose conditions such as liver disease, hemolytic anemia, and blockage of the bile ducts. Bilirubin is an orange-yellow pigment, a waste product primarily produced by the normal breakdown of heme. Heme is a component of hemoglobin, which is found in red blood cells (RBCs). Bilirubin is ultimately processed by the liver to allow its elimination from the body. Any condition that accelerates the breakdown of RBCs or affects the processing and elimination of bilirubin may cause an elevated blood level. Two forms of bilirubin can be measured or estimated by laboratory tests:

- Unconjugated bilirubin-when heme is released from hemoglobin, it is converted to unconjugated bilirubin. It is carried by proteins to the liver. Small amounts may be present in the blood.

- Conjugated bilirubin-formed in the liver when sugars are attached (conjugated) to bilirubin. It enters the bile and passes from the liver to the small intestines and is eventually eliminated in the stool. Normally, no conjugated bilirubin is present in the blood.

In adults and older children, bilirubin is measured to:

- Diagnose and/or monitor diseases of the liver and bile duct (e.g., cirrhosis, hepatitis, or gallstones).
- Evaluate people with sickle cell disease or other causes of hemolytic anemia; these people may have episodes called crises when excessive RBC destruction increases bilirubin levels.
- In newborns with jaundice, bilirubin is used to distinguish the causes of jaundice.
- In both physiologic jaundice of the newborn and hemolytic disease of the newborn, only unconjugated (indirect) bilirubin is increased.
- In much less common cases, damage to the newborn's liver from neonatal hepatitis and biliary atresia will increase conjugated (direct) bilirubin concentrations as well, often providing the first evidence that one of these less common conditions is present.

It is important that an elevated level of bilirubin in a newborn be identified and quickly treated because excessive unconjugated bilirubin damages developing brain cells. The consequences

of this damage include mental retardation, and developmental disabilities, hearing loss, eye movement problems, and death.

Detoxification Function, Phase I

Your body doesn't like to keep any molecules around for a long time. Even "good" molecules, such as hormones, are constantly being disassembled and reconstructed to prepare them to be recycled or eliminated. Thanks to detoxification enzymes, the liver is able to break up most molecules, even toxic and dangerous ones. Enzymes are molecules that act as catalysts in the transformation process. There are thousands of different enzymes, each with a unique role.

Think of this detoxification process as a two-phase wash cycle. Enzymes are like the soap that liberates grease into little droplets, removing impurities that the water can't remove on its own.

In the first part of the wash cycle (Phase 1), enzymes break toxins down into intermediate forms. Some toxins are ready for elimination at this stage, but others require a second wash cycle. In Phase 2, these intermediate compounds are routed along one of six chemically driven detoxification pathways, where they are further broken down, and then bound to specific types of protein molecules which act as "escorts" to guide them out of the body, allowing them to exit through the kidneys (in the form of urine) or the bile (in the form of feces). This process is called conjugation.

When the liver is "sluggish," Phase 1 of the detoxification cycle may not be processing toxins at a normal and necessary speed. This causes toxins to accumulate in the bloodstream. If the hormone estrogen, for example, is not dismantled during Phase 1, the buildup can reach potentially harmful levels. Premenstrual tension can be an expression of this. Many factors can cause Phase 1 to become sluggish. As we age, our detoxification processes slow. Use of medications such as anti-ulcer drugs (cimetidine) and oral contraceptives; exposure to cadmium, lead, and mercury; and consumption of large amounts of sugar and hydrogenated fats hinder Phase 1 detoxification.

Substances that slow down Phase 1 detoxification, setting the stage for a toxic buildup, are called Phase 1 inhibitors. They affect the DNA of the liver cells, causing less detoxification enzymes to be produced. In addition to those mentioned previously, Phase 1 inhibitors include:

- Grapefruit
- Turmeric
- Capsicum (found in hot peppers)
- Cloves
- Drugs containing benzodiazepines and antidepressants
- Antihistamines
- Ketoconazole (used in antifungal medications)
- Toxins from bacteria in the intestines

A different type of detoxification problem develops if Phase 1 breaks down toxins at so fast a rate that Phase 2 cannot keep up. In this situation, the toxic intermediates produced during Phase 1 waiting to be washed out in Phase 2 flood the system. Many of these intermediate compounds-stuck in between Phase 1 and Phase 2-are more dangerous than the original toxin. This bottleneck can become a biochemical nightmare, damaging the liver, brain, and immune system.

Some of the substances that accelerate the breakdown of toxins in the liver by increasing the production of Phase 1 enzymes, without a concurrent increase in Phase 2 enzymes, are known carcinogens-pesticides, paint fumes, and cigarette smoke. Others are well known for their detrimental effects, such as alcohol and steroids. Even some otherwise harmless substances such as limonene from lemons, increase Phase 1 detoxification. But unlike cigarette smoke, limonene does not create dangerous intermediate molecules. As you read the following list, keep in mind that it is not strictly a list of “bad” things, but of those that increase the rate of Phase 1 detoxification, and that this becomes a problem only when Phase 2 can’t keep up.

- Phenobarbital
- Steroids
- Sulfonamide medications
- Foods in the cabbage family
- Charbroiled meats
- High-protein diets
- Citrus fruits
- Vitamin B1
- Vitamin B3
- Vitamin C
- Environmental toxins (exhaust fumes, paint fumes, dioxin, pesticides)
- Cigarette smoke
- Alcohol
- Endotoxins from intestinal bacteria in the bloodstream

Exposure to a toxin, when coupled with exposure to another substance that speeds up Phase 1, is especially dangerous. The combination of alcohol and acetaminophen provides a good example. It’s not uncommon to drink heavily, and later take acetaminophen for the headache that follows. The intermediate compound (from acetaminophen) is an extremely toxic substance called n-acetyl-p-benzoquinoneimine (NAPQI). Under normal conditions, NAPQI is removed quickly during Phase 2, but alcohol intake forces more NAPQI into the liver than Phase 2 can handle.

Research has shown that specific foods and nutrients not only have a beneficial effect on detoxification capability, but can also provide a safe and viable approach to treating a variety of immune disorders and toxicity syndromes.

If two or more detoxification accelerants are combined, they can interact, with serious consequences. An individual on a prescription medication who smokes, for example, actually needs higher dosages of the medication because smoking causes the medication to be broken down faster than it normally would be during Phase 1. If Phase 2 can't handle the extra burden, a detoxification bottleneck results.

You can take steps to keep your liver detoxification system running smoothly. Diet has a strong effect on detoxification enzymes, and foods can help "regulate" or balance Phase 1 and 2 activity. Eating foods that support the liver can reduce your susceptibility to damage from toxins and to conditions such as multiple chemical sensitivity syndrome, chronic fatigue syndrome, and cancer. Research has shown that specific foods and nutrients not only have a beneficial effect on detoxification capability, but can also provide a safe and viable approach to treating a variety of immune disorders and toxicity syndromes.

Essential fatty acids are vital for Phase 1 detoxification, and the standard American diet does not provide an adequate supply of these vital nutrients. Essential fatty acid intake in the form of cold-water fish and flaxseed oils have a demonstrated ability to heighten detoxification. Other sources of essential fatty acids include edible oils, such as those made from sunflower seeds, walnuts, and sesame seeds; wheat germ; and supplements of black current seed, borage, or evening primrose oil.

Eating fresh fruits and vegetables daily is a good way to continually replenish your body's store of glutathione, necessary for one of Phase 2 pathways. High-quality protein nourishes both the amino acid and the sulfation pathways. Vegetable sources of sulfur for the sulfation pathways include radishes, turnips, onions, celery, horseradish, string beans, watercress, kale, and soybeans. Eggs, fish, and meat are also excellent sulfur sources.

Cabbage, brussels sprouts, broccoli, citrus fruits, and lemon peel oils support Phase 2 activity. Studies have shown dramatic results from consuming broccoli sprout extract, which inhibits the activity of Phase 1 enzymes and simultaneously enhances the Phase 2 glutathione pathway. Broccoli sprout extracts are especially beneficial for people who have frequent or high-level exposure to pesticides, exhaust fumes, paint fumes, cigarette smoke, or alcohol. Anyone who is exposed to known carcinogens will benefit from broccoli sprout extract.

Foods to Support Liver Detoxification:

- Cabbage family
- Cold-water fish
- Flaxseed oil
- Fruits (fresh)
- Garlic
- Nuts and seeds
- Onions
- Safflower oil
- Sesame seed oil

- Sunflower seed oil
- Vegetables (fresh)
- Walnut oil
- Wheat germ and wheat germ oil

Nutritional Supplements to Support Liver Detoxification:

- Bioflavonoids
- Black currant seed oil
- Borage oil
- Carotenes
- Coenzyme Q10
- Copper
- Evening primrose oil
- Folic acid
- Iron
- Lecithin
- Magnesium
- Manganese
- N-acetyl-cysteine
- Niacin
- Riboflavin
- Selenium
- Silymarin (milk thistle)
- Trace minerals
- Vitamin A
- Vitamin B6 (pyridoxine)
- Vitamin B12
- Vitamin C (ascorbic acid)
- Vitamin D
- Vitamin E
- Vitamin K
- Zinc

Tests that measure Phase 1 and Phase 2 enzymes take much of the guesswork out of estimating the severity of liver detoxification dysfunction, and can to some extent indicate whether a person is at special risk for cancer, neurological disease, chemical and drug sensitivity, and immune problems.

Detoxification, Phase II, Acetylation

Conjugation of toxins with acetyl-CoA is the primary method by which the body eliminates sulfa drugs. This system appears to be especially sensitive to genetic variation, with those having a poor acetylation system being far more susceptible to sulfa drugs and other antibiotics. While not much is known about how to directly improve the activity of this system, it is known that acetylation is dependent on thiamine, pantothenic acid, and vitamin C.

Detoxification, Phase II, Amino Acid Conjugation
The body manufactures five different types of amino acids that form this detoxification pathway: glycine, taurine, glutamine, arginine, and ornithine. Of these, glycine is the most important for the neutralization of toxins. In some cases, the body cannot make enough glycine to keep up with its own detoxification needs. Though not considered an essential amino acid because the body can make it, glycine production depends on an adequate intake of dietary protein. Individuals who eat a protein-deficient diet have trouble detoxifying environmental pollutants.

Glycine supplies can be depleted by lifestyle stresses. Benzoates for example, found in soft drinks, bind with glycine and rob the body's store of it. One study found that people who consumed a large number of soft drinks had problems breaking down toluene, a common industrial organic solvent. Aspirin also slows down this detoxification pathway because it competes for available glycine in the liver. When the diet is supplemented with glycine, as well as the other nonessential amino acids, there is a noticeable improvement in the detoxification capabilities of many people.

Detoxification, Phase II, Glucuronidation Pathway
Glucuronidation, the combining of glucuronic acid with toxins, in Phase II can be reversed by Beta glucuronidase enzymes produced by pathological bacteria and cause toxins to be reabsorbed, increasing toxicity. Many of the commonly prescribed drugs are detoxified through this pathway. It also helps to detoxify aspirin, menthol, vanillin (synthetic vanilla), food additives such as benzoates, and some hormones. Calcium d-glucarate, a natural ingredient found in certain vegetables and fruits can inhibit beta glucuronidase activity resulting in increased elimination of toxins.

Detoxification, Phase II, Glutathione Conjugation
One of the most important systems in Phase 2 is the glutathione conjugation pathway, which utilizes glutathione for the detoxification of deadly industrial toxins such as PCBs, and the breakdown of carcinogens. Its activity accounts for up to 60 percent of the toxins excreted in the bile. Glutathione also circulates through the bloodstream combating free radicals. No other conjugating substance is as versatile as glutathione and the body's supply of it, most of which is produced by the liver, is easily depleted. Exposure to high levels of toxins exhausts reserves of glutathione, possibly increasing susceptibility to cancer. Chronic disease, HIV, and cirrhosis use up reserves of glutathione. Excessive exercise, which increases oxidative stress and free radical production, and alcohol consumption, which blocks glutathione production, also deplete glutathione in the blood.

Detoxification Function, Phase II, Methylation Pathway
Methylation and glutathione are very tightly intertwined. There is a critical metabolic intersection-a fork in the road-where cells must decide to either make more glutathione, or support more methylation. The overall balance between these two options is crucial to health. Your body can take homocysteine and convert it back to cysteine. Homocysteine is a metabolite of the essential amino acid methionine, and elevated levels have been associated with vascular

disease. Homocysteine is created when methionine donates its methyl group to another molecule in a process known as methylation.

Methylation is a fundamental process of life which is intimately linked to redox status. In chemistry, a methyl group is a hydrocarbon molecule, or CH3. When a substance is methylated, it means that a CH3 molecule has been added to it. Methylation can regulate gene expression, protein function, even RNA metabolism. It can suppress viruses, even latent viruses or cancer viruses we are born with and can help us handle heavy metals. In the liver in particular, methylating a toxin helps change it to a form of the compound that can be more easily processed and excreted.

Methylation is an extremely broad and fundamental action that nature uses to regulate all kinds of processes. It regulates epigenetic changes-changes to gene expression that occur because of environmental factors-by affecting how DNA unravels during development. Some changes can be permanent for the whole lifespan and can even be passed down as many as three generations. That shows that the environment, through the process of methylation, can be quite a profound influence. There are 150-200 methyl transferase enzymes, and each enzyme can methylate multiple targets. So you can imagine methylation as a spider's web within each cell, and that web branches out in many directions.

Methylation and glutathione are very tightly intertwined. There is a critical metabolic intersection-a fork in the road-where cells must decide to either make more glutathione, or support more methylation. The overall balance between these two options is crucial to health, and this occurs with homocysteine. When methionine gives away its methyl group, we're left with homocysteine. And the body has to decide, should homocysteine be methylated, and go back into methionine, or should it be converted into cysteine, so that the body can make more of the antioxidant glutathione? This fundamental decision is made again and again by the body, and the overall balance is crucial to health. Too little glutathione and we will end up with free radical, oxidative damage. Not enough methylation, and many genes and viruses will not be properly regulated. Excess homocysteine, and the risk of vascular disease goes up.

Detoxification, Phase II, Sulfation Pathway

The weakest pathway in most people, from a dietary standpoint, is sulfation, the one responsible for the transformation of neurotransmitters, steroid hormones, drugs, industrial chemicals, phenolics (compounds derived from benzene, commonly used in plastics, disinfectants, and pharmaceuticals), and especially toxins from intestinal bacteria and the environment. Intake of too little dietary sulfur, a molecule that must come from our diets, is a cause of ineffective detoxification. If your exposure to substances that need to be detoxified via the sulfation pathway is high, but your sulfate reserves are low due to an inadequate diet, you will not be able to break down these toxins.

Studies have established a strong association between the function of the sulfation pathway and a variety of illnesses including Alzheimer's disease, Parkinson's disease, motor neuron disease, autism, primary biliary cirrhosis, rheumatoid arthritis, food sensitivity, and multiple chemical sensitivity. A comprehensive detoxification profile test identifies alterations in this pathway.

Energy Production Function
Understanding the liver's role in energy production clarifies how a compromised liver can result in fatigue. The liver is intimately involved in supplying the body with energy. The liver converts glucose into glycogen, storing it for later use. When the body needs energy, liver glycogen can release glucose to provide fuel for creating a burst of energy. Additionally, if the body is low in carbohydrates, the liver can manufacture more from fat or proteins.

By producing, storing and supplying the body with glucose, the liver is a key player in preventing fatigue. A liver unaffected by disease releases glucose between meals, or whenever the cells need nourishment and energy. While a healthy liver maintains a steady level of energy throughout the day, one hampered by disease has a reduced ability to produce glucose, and less space to store it.

For those with liver disease, the continued, long-term response of the immune system contributes to fatigue. The release of neurotransmitters (chemicals in the brain) is part of a healthy immune system response. When the body is physically or emotionally stressed, the immune system activates, causing the brain to release the appropriate substance for self-protection. Liver disease causes a chronic, uncontrollable stress to the patient, weakening the immune system and decreasing the release of certain neurotransmitters.

Liver Fat Content
Fatty liver is a condition in which the cells of the liver accumulate abnormally increased amounts of fat. Although excessive consumption of alcohol is a very common cause of fatty liver (alcoholic fatty liver), there is another form of fatty liver, termed nonalcoholic fatty liver disease (nonalcoholic fatty liver disease), in which alcohol has been excluded as a cause. In nonalcoholic fatty liver disease, other recognized causes of fatty liver that are less common causes than alcohol also are excluded.

Nonalcoholic fatty liver disease is a manifestation of an abnormality of metabolism within the liver. The liver is an important organ in the metabolism (handling) of fat. The liver makes and exports fat to other parts of the body. It also removes fat from the blood that has been released by other tissues in the body, for example, by fat cells, or absorbed from the food we eat. In nonalcoholic fatty liver disease, the handling of fat by liver cells is disturbed. Increased amounts of fat are removed from the blood and/or are produced by liver cells, and not enough is disposed of or exported by the cells. As a result, fat accumulates in the liver.

Nonalcoholic fatty liver disease is classified as either fatty liver (sometimes referred to as isolated fatty liver or IFL) or steatohepatitis (NASH). In both isolated fatty liver and NASH there is an abnormal amount of fat in the liver cells, but, in addition, in NASH there is inflammation within the liver, and, as a result, the liver cells are damaged, they die, and are replaced by scar tissue.

Nonalcoholic fatty liver disease is important for several reasons. First, it is a common disease, and is increasing in prevalence. Second, NASH is an important cause of serious liver disease, leading to cirrhosis and the complications of cirrhosis–liver failure, gastrointestinal bleeding, and liver cancer. Third, nonalcoholic fatty liver disease is associated with other very common and serious non-liver diseases, perhaps the most important being cardiovascular disease that leads to heart disease and strokes. Fatty liver probably is not the cause of these other diseases, but is a manifestation of an underlying cause that the diseases share. Fatty liver, therefore, is a clue to the presence of these other serious diseases which need to be addressed.

Protein Metabolism

The liver synthesizes non-essential amino acids from other amino acids, glucose and fatty acids. The enzymes alanine and aspartate transaminases convert amino acids that are in abundance to others that are needed by the body. A high concentration of these enzymes in the blood indicates liver damage. The liver makes most plasma proteins including albumin and produces coagulation factors. The liver breaks down proteins and removes the toxic ammonium ion by converting it to urea. Serum Globulin; a globulin or mixture of globulins occurring in blood serum and containing most of the antibodies of the blood. The serum globulin electrophoresis test measures the levels of proteins called globulins in the fluid part of a blood sample. This fluid is called serum, one of a group of proteins in blood serum with antibody qualities. The various types of serum globulins, designated alpha, beta, and gamma, have different specific properties. Serum total bile acid; Serum total bile acid (TBA) levels are used clinically as a sensitive and reliable index of hepatobiliary diseases. In the present study, to assess the clinical usefulness of determining TBA in interferon (IFN)-treated patients, changes in liver function test values, including TBA and liver histology, were examined in 36 chronic hepatitis C patients for 3 years after a sustained response to IFN treatment. Total bilirubin Bilirubin is a brownish yellow substance found in bile. It is produced when the liver breaks down old red blood cells. Bilirubin is then removed from the body through the stool (feces) and gives the stool its normal color. A bilirubin test measures the amount of bilirubin in a blood sample. Total bilirubin and direct bilirubin levels are measured directly in the blood, whereas indirect bilirubin levels are derived from the total and direct bilirubin measurements. When bilirubin levels are high, the skin and whites of the eyes may appear yellow (jaundice). Jaundice may be caused by liver disease (hepatitis), blood disorders (hemolytic anemia), or blockage of the tubes (bile ducts) that allow bile to pass from the liver to the small intestine.

Serum Globulin (A/G)

This measures the levels of protein called globulins. This indicator provides information about how well your immune system is working. This area can also indicate immune system disorders, cancers such as multiple myeloma and other conditions.

Serum Total Bile Acid (TBA)

Abnormal readings can be an indication of sluggish liver function, damage or injury, or other diseases. Provides overall indication on how well the liver may be functioning.

Total Bilirubin (TBIL)

Bilirubin can be an indication on the overall function of the liver. High readings can indicate different types of liver or bile duct problems. Higher numbers can indicate destruction of red blood cells.

LUNG FUNCTION

Airway Resistance RAW
The airway resistance, which in science and medicine is abbreviated as Raw. For air to move into or out of your lungs, it must want to, and it has to overcome friction, the force that stops two things from sliding past each other. Airway resistance is a measure of the resistance to lung airflow caused by friction. The resistance of your lung to airflow is a determinant of how easy it is to breathe; That's why scientists like to measure it. Knowing the airway resistance helps doctors tell if your lungs are functioning normally.

The first formula for airway resistance involves figuring out the change in pressure from where air enters (your mouth) to where it ends up, the part of the lung called the alveoli. The pressure of the lung where air enters is the same as the pressure of the atmosphere, while the pressure of the alveoli (Palv) is determined by other factors. The most common unit of pressure used for the lung is centimeters of water (cmH2O). The other part involves flow rate (V dot), or how fast the air flows. Since air isn't solid, it's most often measured by how much volume in liters it occupies, and since it moves so fast, time is usually measured in seconds.

Arterial Oxygen Content (PaCO2)
The definition is the amount of oxygen bound to hemoglobin (1.34 * Hb * SaO2) plus the oxygen dissolved in plasma (0.0031 * PaO2). The arterial oxygen content equation: CaO2 = (1.34 * Hb * SaO2) + (0.0031 * PaO2). The normal oxygen combining capacity is 1.39 mls/gram, however due to abnormal forms of hemoglobin such as carboxyhemoglobin and methemoglobin this value is reduced to 1.34 mls/gram. Hb is Hemoglobin, the normal Hb for males is 14-20 g/dl and females 12-15 g/dl. SaO2 is the percentage of available hemoglobin that is saturated with oxygen, this value is from a direct measurement of an arterial blood gas. 0.0031 is the solubility coefficient of oxygen at body temperature. PaO2 is the partial pressure of oxygen in arterial blood not bound to hemoglobin.

Total Lung Capacity (TLC)
The inspiratory capacity plus the functional residual capacity; the volume of air contained in the lungs at the end of a maximal inspiration. The average total lung capacity of an adult human male is about 6 liters of air. Tidal breathing is normal, resting breathing; the tidal volume is the volume of air that is inhaled or exhaled in only a single such breath.

Vital Capacity (VC)

This is the maximum amount of air a person can expel from the lungs after a maximum inhalation. It is equal to the sum of inspiratory reserve volume, tidal volume, and expiratory reserve volume.

BODY REPRODUCTIVE FUNCTION: FEMALE

Beta hCG Hormone
The human chorionic gonadotropin (hCG) test is done to check for the hormone hCG in blood or urine. HCG is made by the placenta during pregnancy. HCG may also be made by certain tumors, especially those that come from an egg or sperm. (These are called germ cell tumors.) HCG levels are often tested in a woman who may have tissue that is not normal growing in her uterus. The test also may be done to look for molar pregnancy or cancer inside the uterus. Several hCG tests may be done after a miscarriage to be sure a molar pregnancy is not present. In a man, hCG levels may be measured to help see if he has cancer of the testicles.

Cervicitis
This is inflammation of the cervix, which can be due to: Irritation, Infection, or Injury of cells that line the cervix. These irritated or infected tissues may become red, swollen, and ooze mucus and pus. They may also bleed easily when touched.

Cervicitis is common. It may be caused by a number of factors, including infections, chemical or physical irritations, and allergies. Determining the cause of cervicitis is important. If an infection is the problem, it can spread beyond the cervix to the uterus and fallopian tubes and into the pelvic and abdominal cavity and cause life-threatening infection. This may cause problems with fertility –the ability to become pregnant. Or it may cause problems with your unborn baby if you are already pregnant.

Endometriosis
This is a condition in which tissue that normally grows inside the uterus (endometrium) grows outside it. Most often this is on the ovaries, fallopian tubes, and tissue around the uterus and ovaries; however, in rare cases it may also occur in other parts of the body. The main symptoms are pelvic pain and infertility. Nearly half of those affected have chronic pelvic pain, while in 70% pain occurs during menstruation. Pain during sex is also common. Infertility occurs in up to half of women affected. Less common symptoms include urinary or bowel symptoms. About 25% of women have no symptoms. Endometriosis can have both social and psychological effects.

The cause is not entirely clear. Risk factors include having a family history of the condition. The areas of endometriosis bleed each month, resulting in inflammation and scarring. The growths due to endometriosis are not cancer. Diagnosis is usually based on symptoms in combination with medical imaging. Biopsy is the most sure method of diagnosis. Other causes of similar symptoms include pelvic inflammatory disease, irritable bowel syndrome, interstitial cystitis, and fibromyalgia.

Fallopian Tube Dysfunction
The fallopian tube may be blocked or damaged, preventing the egg from moving from the ovary to the uterus to be implanted. The fallopian tubes can sometimes be repaired, but in vitro fertilization is usually recommended.

Causes of fallopian tube problems include the following:

- Pelvic infections (such as pelvic inflammatory disease)
- A chlamydial infection
- Use of an intrauterine device if it causes a pelvic infection (which is rare)
- A ruptured appendix
- Surgery in the pelvis or lower abdomen
- A mislocated (ectopic) pregnancy in the fallopian tubes

Bacteria, such as those that can cause pelvic inflammatory disease or chlamydial infection (chlamydiae), can enter the vagina during sexual intercourse with a partner who has a sexually transmitted disease. The bacteria can spread from the vagina to infect the cervix. They may then spread upward, to the uterus and sometimes the fallopian tubes. Chlamydiae can infect the fallopian tubes without causing any symptoms. These infections may permanently damage the fallopian tubes, uterus, and surrounding tissue. Scar tissue may form and block the fallopian tubes.

Other causes of fallopian tube problems include abnormalities in the pelvis that block the tubes such as:

- Birth defects of the uterus and fallopian tubes
- Endometriosis
- Fibroids in the uterus
- Bands of scar tissue between adhesions in the uterus or pelvis

Fibroadenoma of Breast
Benign tumors characterized by an admixture of stromal and epithelial tissue. Since both fibroadenomas and breast cancer can appear as similar lumps, it is currently recommended to perform ultrasound analyses and possibly tissue sampling with subsequent histopathologic analysis in order to perform diagnosis. Unlike typical lumps from breast cancer, fibroadenomas are easy to move, with clearly defined edges.

There is research suggesting that fibrocystic breast disease correlates with iodine deficiency. From Dr. Brownstein's book, Iodine Why You Need It and Why You Can't Live Without It:

Animal studies have shown conclusively that an iodine deficient state can alter the structure and function of the breasts. After my own research and study, I concur with several investigators that iodine deficiency is a causative factor in breast cancer and fibrocystic breast disease. I believe it is essential that women have their iodine levels tested, and if it is shown there is an iodine deficiency, iodine supplementation should be initiated.

The breasts are one of the body's main storage sites for iodine in the body. In an iodine-deficient state, the thyroid gland and the breasts will compete for what little iodine is available. Therefore, this will leave the thyroid gland and the breasts iodine depleted and can set the stage for illnesses such as goiter, hypothyroidism, autoimmune thyroid disease, breast illnesses including cancer, and cystic breast disease. In addition, other glandular tissues such as the ovaries which contain the second highest concentration of iodine in the body, will also be depleted in an iodine deficient state.

Hyperplasia of Mammary Glands

The most common type of proliferative breast condition is hyperplasia. There are two types of hyperplasia: usual hyperplasia (more common) and atypical hyperplasia (less common). In usual hyperplasia (the most common form of hyperplasia) the proliferating (dividing) cells look normal under a microscope. Women with usual hyperplasia have about twice the breast cancer risk of women without a proliferative breast condition. In atypical hyperplasia, the proliferating (dividing) cells look abnormal. Atypical hyperplasia is less common than usual hyperplasia. Women with atypical hyperplasia have about 3-5 times the breast cancer risk of women without a proliferative condition. One study found women diagnosed with atypical hyperplasia had about a 29 percent chance of developing breast cancer within 25 years. Atypical ductal hyperplasia (ADH) is not a form of breast cancer. Rather, it is a marker for women who may have a risk factor for developing breast cancer in the future. If you have a biopsy that shows atypical ductal hyperplasia in one of your breasts, your doctor will want to follow your breast health very carefully.

Mastitis

Mastitis is an infection and inflammation of the breast, usually the fatty tissue of the breast, that causes redness, pain and swelling. As this swelling pushes on the milk ducts, it causes pain.

Mastitis is usually caused by an infection with the bacteria Staphylococcus aureus. These bacteria are normally present on your skin, but cause problems when they enter the body. Bacteria causing mastitis enter through a break or crack in the skin of the breast, usually on the nipple. In fact, mastitis usually occurs in women who are breastfeeding because the nipples often become dry and irritated and can become cracked during nursing. This allows the bacteria to invade breast tissue, in particular the milk ducts and milk glands.

Mastitis in a non breastfeeding woman is more common after menopause than before. In very rare cases, this may indicate the presence of another primary disease, such as breast cancer. At the same time, a clogged milk duct can mimic mastitis. While a woman adjusts to

breastfeeding a new infant, the milk ducts inside the breast can become clogged, causing tenderness, redness, lumps and even heat under the skin surface, but without infection.

Menopause
Menopause is the permanent end of menstruation. It is not a disease, but it can have a big impact on a woman's well-being. Menopause can bring physical discomfort from hot flashes, night sweats, sleep issues, vaginal dryness and other symptoms. Age is the leading cause of menopause. It's the end of a woman's childbearing years, brought on by the ovaries gradually slowing down. Certain surgeries and medical treatment can induce menopause. Those include surgical removal of the ovaries (bilateral oophorectomy), chemotherapy, and pelvic radiation therapy. Having a hysterectomy (surgical removal of the uterus) without removing the ovaries does not lead to menopause, although you will not have periods anymore. There is no proven way to predict menopause age. It's only after a woman has missed her periods for 12 straight months, without other obvious causes, that menopause can be confirmed.

Ovarian Cyst
There are various types of ovarian cysts, such as dermoid cysts and endometrioma cysts. However, functional cysts are the most common type. The two types of functional cysts include follicle and corpus luteum cysts.

During a woman's menstrual cycle, an egg grows in a sac called a follicle. This sac is located inside the ovaries. In most cases, this follicle or sac breaks open and releases an egg. But if the follicle doesn't break open, the fluid inside the follicle can form a cyst on the ovary. Follicle sacs typically dissolve after releasing an egg. But if the sac doesn't dissolve and the opening of the follicle seals, additional fluid can develop inside the sac and this accumulation of fluid causes a corpus luteum cyst.

Other types of ovarian cysts include: dermoid cysts which are sac-like growths on the ovaries that can contain hair, fat, and other tissue, cystadenomas: non-cancerous growths that can develop on the outer surface of the ovaries, endometriomas: tissues that normally grow inside the uterus can develop outside the uterus and attach to the ovaries, resulting in a cyst.

Some women develop a condition called polycystic ovary syndrome. This condition means the ovaries contain a large number of small cysts. It can cause the ovaries to enlarge, and if left untreated, polycystic ovaries can cause infertility. (see iodine, under minerals)

Oftentimes, ovarian cysts do not cause any symptoms. However, symptoms can appear as the cyst grows. Symptoms may include:

- abdominal bloating or swelling
- painful bowel movements
- pelvic pain before or during the menstrual cycle
- painful intercourse
- pain in the lower back or thighs

- breast tenderness
- nausea and vomiting

Severe symptoms of an ovarian cyst that require immediate medical attention include:

- severe or sharp pelvic pain
- fever
- faintness or dizziness
- rapid breathing

These symptoms can indicate a ruptured cyst or an ovarian torsion. Both complications can have serious consequences if not treated early.

Ovulation
It was commonly believed that we always ovulated whenever we were having regular menstrual flow with normal-length menstrual cycles of 21-35 days apart. CeMCOR and other groups of scientists have now shown that variability in ovulation and huge variation in the amount of progesterone that each menstrual cycle makes are very common. This frequent but not obvious cycle variation is called an “ovulatory disturbance” that includes not releasing an egg (anovulation) as well as releasing an egg with too short a time from egg-release to the next flow (short luteal phase). Ovulatory disturbances are silent within regular and normal menstrual cycles. It is still true, however, that irregular or far apart cycles are even more likely to have ovulatory disturbances. Who’s at increased risk for silent, ovulatory disturbances? We don’t know for sure because few studies have tracked women’s cycles for ovulation over extended periods. Adolescents and young women (in the first 10 years after first period or menarche) are more likely to have ovulatory disturbances; irregular flow is also common in the first year.

Also, women in perimenopause have increasing ovulatory disturbances; luteal lengths can be normal but progesterone production is too low during this life phase. Obesity is associated with ovulatory disturbances, as is cigarette smoking. But probably the most common reason for having a regular cycle with too little or no progesterone production is being under stress: the “threat” can be physical (illness, over-exercise), emotional (break-up with a partner, grief, depression), nutritional (not being able to afford or get to, enough nutritious food or not eating enough for body needs), social (bullying, sexual abuse, social isolation) or spiritual (not feeling life has fundamental meaning). Thus CeMCOR investigators have come to see a normally ovulatory, regular menstrual cycle as a sign of health and well-being.

Pelvic Inflammatory Disease (PID)
This is an infection of the organs of a women’s reproductive system. They include the uterus, ovaries, fallopian tubes, and cervix. It’s usually caused by a sexually transmitted infection (STI), like chlamydia or gonorrhea, and is treated with antibiotics.

You might not notice any symptoms of PID early on. But as the infection gets worse, you can have:

- Pain in your lower belly and pelvis
- Heavy discharge from your vagina with an unpleasant odor
- Bleeding between periods
- Pain during sex
- Fever and chills
- Pain when you pee or a hard time going

Call your doctor right away if you have any of these.

PID can cause serious problems if it's not treated. For example, you might have trouble getting pregnant or have pain in your pelvic area that doesn't go away.

Premenstrual Syndrome (PMS)
Premenstrual syndrome (PMS) is a combination of emotional, physical, psychological, and mood disturbances that occur after a woman's ovulation, typically ending with the onset of her menstrual flow. The most common mood-related symptoms are irritability, depression, crying, oversensitivity, and mood swings. The most common physical symptoms are fatigue, bloating, breast tenderness (mastalgia), acne, and appetite changes with food cravings.

A more severe form of PMS, known as premenstrual dysphoric disorder (PMDD), also known as late luteal phase dysphoric disorder, occurs in a smaller number of women and leads to significant loss of function because of unusually severe symptoms. The American Psychiatric Association characterizes PMDD as a severe form of PMS in which anger, irritability, and anxiety or tension are especially prominent.

About 90% of women experience premenstrual symptoms at some point in their lifetime. The true incidence of PMS has often been overestimated by including all women who experience any physical or emotional symptoms prior to menstruation. It is estimated that clinically significant PMS (which is moderate to severe in intensity and affects a woman's functioning) occurs in 20% to 30% of women. It is generally most severe in women in their 4th decade of life.

Vaginitis
Vaginitis is inflammation of the vagina. In premenopausal women, infection is the most common cause. After menopause, a low level of estrogen often leads to vaginal atrophy (atrophic vaginitis). Vaginitis also can be the result of an allergic reaction to an irritating chemical, such as a spermicide, douche or bath soap.

Almost all infectious vaginitis is caused by one of three infections:

Bacterial vaginosis is a change in the type of bacteria that normally live in the vagina, and it is the most common cause of an abnormal vaginal discharge or an unpleasant vaginal odor. In bacterial vaginosis, normal Lactobacillus bacteria are replaced by other bacteria, including Prevotella, Mobiluncus, G. vaginalis, and Mycoplasma hominis. The exact reason for this

change is unknown. In pregnant women, bacterial vaginosis can increase the risk of premature delivery.

Candida vaginal infections, also called vaginal yeast infections, typically are caused by the Candida albicans fungus. During a lifetime, 75% of all women are likely to have at least 1 Candida vaginal infection, and up to 45% have 2 or more. Women tend to be more susceptible to vaginal yeast infections if their bodies are under stress from poor diet, lack of sleep or illness, or if they are pregnant, taking antibiotics or birth control pills or douching too often. Women with diabetes or human immunodeficiency virus (HIV) are more likely to have recurrent yeast infections.

Trichomonas vaginitis, also called trichomoniasis, is a sexually transmitted disease (STD) caused by a microscopic one-celled organism called Trichomonas vaginalis. Trichomonas causes inflammation of the vagina, cervix and urethra in women. In pregnant women, Trichomonas infections also can increase the risk of premature rupture of the membranes and preterm delivery.

Symptoms:
Bacterial vaginosis – Bacterial vaginosis causes an abnormal grayish-white vaginal discharge with a foul-smelling vaginal odor.

Candida vaginitis – Candida vaginitis can cause the following symptoms:
Vaginal itch or soreness
A thick cheese-like vaginal discharge
Burning discomfort around the vaginal opening, especially if urine touches the area
Pain or discomfort during sexual intercourse

Trichomonas – In women, Trichomonas organisms can live in the vagina for many years without causing any symptoms. If symptoms occur, they can include:
A yellow-green, foul-smelling vaginal discharge
Vaginal pain or itching
Irritation and inflammation around the vaginal opening
Discomfort in the lower abdomen
Vaginal pain during sexual intercourse
Burning discomfort during urination

Symptoms can be worse during a menstrual period.

BODY REPRODUCTIVE FUNCTION: MALE

Erection Transmitter

An erection (clinically: penile erection or penile tumescence) is a physiological phenomenon in which the penis becomes firmer, engorged and enlarged. Penile erection is the result of a complex interaction of psychological, neural, vascular and endocrine factors, and is often associated with sexual arousal or sexual attraction, although erections can also be spontaneous. The shape, angle and direction of an erection varies considerably in humans. Physiologically, erection is triggered by the parasympathetic division of the autonomic nervous system (ANS), causing nitric oxide (a vasodilator) levels to rise in the trabecular arteries and smooth muscle of the penis. The arteries dilate causing the corpora cavernosa of the penis (and to a lesser extent the corpora spongiosum) to fill with blood; simultaneously the ischiocavernosus and bulbospongiosus muscles compress the veins of the corpora cavernosa restricting the egress and circulation of this blood. Erection subsides when parasympathetic activity reduces to baseline.

As an autonomic nervous system response, an erection may result from a variety of stimuli, including sexual stimulation and sexual arousal, and is therefore not entirely under conscious control. Erections during sleep or upon waking up are known as nocturnal penile tumescence (NPT). Absence of nocturnal erection is commonly used to distinguish between physical and psychological causes of erectile dysfunction and impotence.

Liquefaction Time
Semen is a thick gel at the time of ejaculation. It normally becomes liquid within 20 minutes after ejaculation. Liquefaction time is the time it takes for the semen to turn to liquid.

Prostatic Calcification
Prostate calcification is another name for the calcified stones that can develop in the prostate. Although prostate calcification can be nothing to worry about, it can also be a sign of a more serious underlying condition. One of the most common causes of such stones is BPH, benign prostatic hypertrophy.

Prostatic Hyperplasia
Benign prostatic hyperplasia (BPH), also called benign enlargement of the prostate (BEP or BPE), is a noncancerous increase in size of the prostate. BPH involves hyperplasia of prostatic stromal and epithelial cells, resulting in the formation of large, fairly discrete nodules in the transition zone of the prostate. BPH involves hyperplasia (an increase in the number of cells) rather than hypertrophy (a growth in the size of individual cells), but the two terms are often used interchangeably, even among urologists.

Prostatitis Syndrome
Chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS) is characterized by pelvic or perineal pain without evidence of urinary tract infection, lasting longer than 3 months, as the key symptom. Symptoms may wax and wane. Pain can range from mild to debilitating. Pain may radiate to the back and rectum, making sitting uncomfortable. Pain can be present in the perineum, testicles, tip of penis, pubic or bladder area. Dysuria, arthralgia,myalgia, unexplained fatigue, abdominal pain, constant burning pain in the penis, and frequency may all be present.

Frequent urination and increased urgency may suggest interstitial cystitis (inflammation centered in bladder rather than prostate). Post-ejaculatory pain, mediated by nerves and muscles, is a hallmark of the condition, and serves to distinguish CP/CPPS patients from men with BPH or normal men. Some patients report low libido, sexual dysfunction and erectile difficulties.

PSA
PSA is a protein produced by the prostate gland. Although most PSA is carried out of the body in semen, a very small amount escapes into the bloodstream.
The PSA value used most frequently as the highest normal level is 4 ng/mL (nanograms per milliliter). However, since the prostate gland generally increases in size and produces more PSA with increasing age, it is normal to have lower levels in young men and higher levels in older men. Age-specific PSA levels are as follows (age group, upper normal): (40 – 49, 2.5), (50 – 59, 3.5), (60 – 69, 4.5), (70 – 79, 6.5). The use of age-specific PSA ranges for the detection of prostate cancer is controversial. Not all studies have agreed that this is better than simply using a level of 4 ng/mL as the highest normal value.

Semen Volume
This is a measure of how much semen is present in one ejaculation.

Sperm Count
This counts the number of sperm present per milliliter (mL) of semen in one ejaculation.

Sperm Fructose Level
This is a measure of the amount of a sugar called fructose in the semen. The fructose provides energy for the sperm.

Sperm Morphology
This is a measure of the percentage of sperm that have a normal shape.

Sperm Motility Rate
This is a measure of the percentage of sperm that can move forward normally. The number of sperm that show normal forward movement in a certain amount of semen can also be measured. This is called motile density.

Sperm pH
This is a measure of the acidity (low pH) or alkalinity (high pH) of the semen.

Sperm White Blood Cell Count
This counts the number of sperm present per milliliter (mL) of semen in one ejaculation.

SKIN INDEX

Skin Callus
A callus (or callosity) is a toughened area of skin which has become relatively thick and hard in response to repeated friction, pressure, or other irritation. Rubbing that is too frequent or forceful will cause blisters rather than allow calluses to form. Since repeated contact is required, calluses are most often found on feet because of frequent walking. Calluses are generally not harmful, but may sometimes lead to other problems, such as skin ulceration or infection.

Skin Collagen
Collagen is a vital fibrous protein that is found all throughout the body; it connects and supports tissues including skin, bone, muscles, tendons, cartilage and organs. It's the main protein in connective tissue and is responsible for skin firmness and suppleness as your skin loses collagen, it loses elasticity and, on average, we lose about 1% of our collagen every year after the age of 20!

The more collagen we lose, the more fine lines and wrinkles appear, which is why it is essential that we work to increase our collagen levels as we age. We accomplish this not only through topical products, but also by living a healthy lifestyle, which addresses nutritional and emotional needs for optimal skin health. Try eating foods that are rich in collagen boosting ingredients such as embryonic foods that contain amino acids (eggs, beans and seeds), antioxidants, which inhibit damage to collagen (pomegranates and goji berries are great) and good fats (like walnuts and avocado). Also, do your best to avoid exposure to sun, pollution, cigarettes, alcohol, drugs, pesticides, toxins and stress, which all contribute to collagen loss and ultimately older looking skin.

Skin Elasticity
The protein elastin is found in connective tissues throughout the body. It is notably found in the extracellular matrix of the skin as well as the internal organs of the body. The elastin protein is flexible and gives many tissues their elasticity. The ability of skin to stretch and then return to its normal state afterward is called elasticity. Unfortunately, a loss of elasticity in the skin is a natural part of aging known as elastosis. Elastosis may be worse in people who spend a lot of time in the sun. UVA (aging) and UVB (burning) rays weaken the skin's support system of collagen and elastin – thereby accelerating the skin's aging process.

Skin Free Radical
Free radicals are charged chemical particles of oxygen that enter into destructive chemical bonds with organic substances such as proteins. The result is an oxidation, or chemical burning, of the substance, which destroys it. Protein is denatured, genes may be broken and dangerous residual substances may result from the chemical changes. Exposure to sunlight is known to lead to oxidative destruction of the skin, including increased incidence of skin cancer and the collagen-destroying processes causing wrinkling. Strenuous aerobic activity has been associated with increased free radical formation. The evidence of free radical production leading

to oxidation and tissue damage is real. Free radicals cause damage to our skin's DNA that can speed along skin aging. This is called the free radical theory of aging.

Sleep enables the body to reverse everyday free radical damage by replenishing energy, building new cells and repairing connective tissue. Because sleep is an ideal time for cellular renewal and overall repair for the skin and other organs, poor sleep is quite apparent in the complexion.

Other things that can support the body in fighting free radicals include Vitamin C, Vitamin E, and melatonin. The combination of vitamin C, vitamin E and melatonin may represent one of the most effective ways to get enough of these antioxidants into the skin to impede collagen destruction, encourage collagen production, reduce facial wrinkles and undo sun damage.

Foods such as citrus fruits, carrots and pomegranates are high on the long list of healthy sources of antioxidants. Green tea is a great source of the powerful antioxidant group called catechins. Lycopene is perhaps the most potent dietary antioxidant. It is found in abundant supply in tomatoes, carrots and other yellow, red and orange fruits and vegetables. Cold water fish provides essential omega-3's which can also be beneficial.

Skin Grease

Oil(sebum) is produced by sebaceous glands and secreted through pores. Sebaceous glands are microscopic exocrine glands in the skin that secrete an oily matter called sebum, to lubricate and waterproof the skin and hair. In humans, they are in the face and scalp, everywhere, except the palms of the hands and soles of the feet. The type of secretion of the sebaceous glands is referred to as holocrine.Nasal sebum, also known as nose grease/oil, is grease removed from the surface of the human nose. The pores of the lateral creases (where the nose joins the face) of the exterior of the nose create and store more oil and grease than pores elsewhere on the human body, forming a readily available source of small quantities of grease or oil. The grease is a particularly oily form of sebum.

Skin Immunity

Skin immunity is a property of skin that allows it to resist infections from pathogens. In addition to providing a passive physical barrier against infection, the skin also contains elements of the innate and adaptive immune systems which allows it to actively fight infections.

Skin Inflammation

Skin inflammation can be characterized as acute or chronic. Acute inflammation can result from exposure to UV radiation (UVR), ionizing radiation, allergens, or to contact with chemical irritants (soaps, hair dyes, etc.). This type of inflammation is typically resolved within 1 to 2 weeks with little accompanying tissue destruction. In contrast, chronic inflammation results from a sustained immune cell mediated inflammatory response within the skin itself. This

inflammation is long lasting and can cause significant and serious tissue destruction. When the skin is exposed to a “triggering” stimulus, such as UV radiation, an irritant (e.g. soaps or fragrances), or to allergens, the cells in the skin produce a variety of inflammatory “hormones” called cytokines and chemokines. These “inflammatory messengers” bind to specific receptors on target cells and stimulate the production of additional inflammatory signaling “hormones”. Some of these cause vasodilation while others activate nerve cells. Still other cytokines cause immune cells to leave the blood and migrate into the skin where they then produce more inflammatory hormones, as well as enzymes, free radicals, and chemicals that damage the skin. The result of the initial triggering event is the amplification of a large inflammatory response that, while designed to help the skin fight infection from invading bacteria, actually causes considerable damage to the skin.

Skin Melanin
This is the pigment that gives human skin, hair, and eyes their color. Dark-skinned people have more melanin in their skin than light-skinned people have. Melanin is produced by cells called melanocytes. It provides some protection against skin damage from the sun, and the melanocytes increase their production of melanin in response to sun exposure. Freckles, which occur in people of all races, are small, concentrated areas of increased melanin production.
This hormone is also linked to ED issues using PT141 to stimulate erections.

Skin Moisture
Skin has what is called a “moisture barrier.” This is the barrier of the skin that is responsible for keeping moisture in and bad bacteria out (keeping in mind that there’s always a mix of yeast and p. acnes bacteria, among others, present on the skin). However, this barrier can become stripped away, which makes skin lose moisture at a rapid rate, leading to the production of more sebum (oil) to “compensate,” as well as more bacteria to feed on the dead skin cells and sebum. As a result, skin becomes more sensitive, dry, oily, dull, and potentially broken out. It also will heal slower and respond more viciously to skin remodelers (actives such as AHA, BHA, BP, sulfur, and tretinoin).
Dehydrated skin can present itself differently in many people. it usually has two or more of the following symptoms:

- Lackluster, dull
- Sallow or “tired,” almost sickly looking
- Has no real “bounce” or spring to it — looks dry and wrinkly when pulled taut
- Prone to congestion, particularly closed comedones
- Burns and feels irritated when applying bland moisturizers
- Feels very dry and tight when cleansed
- Very oily in appearance, but feels bone dry in places and flakes very badly in spots

However, before explaining methods to fix dehydrated skin, you need to first understand why skin becomes dehydrated.

Information from these sites:

https://www.nuskin.com/en_US/corporate/company/science/personal_care_science/collagen.html
https://www.makeup.com/what-are-free-radicals
http://www.medicinenet.com/script/main/art.asp?articlekey=4340
http://burkewilliamsspa.com/2014/10/23/5-reasons-must-moisturize-skin-2/
http://www.dermamedics.com/inflammation_id55.html
https://www.murad.com/blog/collagen-elastin-the-skins-youth-proteins/
http://www.skininc.com/skinscience/ingredients/Antioxidants-Free-Radicals-and-Skin-Care-227888041.html#sthash.vSxid650.dpuf

THYROID FUNCTION

Thyroid Function (TFTs)
This is a collective term for blood tests used to check the function of the thyroid. TFTs may be requested if a patient is thought to suffer from hyperthyroidism (overactive thyroid) or hypothyroidism (underactive thyroid), or to monitor the effectiveness of either thyroid-suppression or hormone replacement therapy.

The thyroid is a butterfly-shaped gland that sits low on the front of the neck. Your thyroid sits just below your Adam's apple, along the front of the windpipe. The thyroid has two side lobes, connected by a bridge in the middle. When the thyroid is its normal size, you will not even be able to feel it. The thyroid is responsible for controlling energy consumption by releasing hormones that control your metabolism. It also regulates body temperature, weight, and heart rate.

Here's a perfect example of what your thyroid does; it works very similar to the thermostat in your house. If the thyroid is too active and produces too much of the T4 and T3 hormones (which control your body's metabolism), it's like having a thermostat that's set too high…So the house gets overheated. If it's not active enough, it's set too low and the house is too cold. And if it's making just the right amount of T4 and T3 hormones, then it keeps the temperature just right.

Anti-Thyroglobulin Antibody
Your thyroid uses thyroglobulin to make the active thyroid hormones.
If you have an autoimmune condition, it can disrupt your production of thyroglobulin. An autoimmune condition happens when your immune system creates antibodies that attack your body's own healthy cells. When your immune system attacks the thyroid, it often targets thyroglobulin. This causes it to produce antithyroglobulin antibodies.

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If you do have small amounts in your blood, it may be a sign of certain health problems, such as:

- Type 1 diabetes
- Pernicious anemia, a drop in red blood cells caused by a vitamin B-12 deficiency
- Collagen vascular diseases, such as rheumatoid arthritis and scleroderma
- Thyroid cancer

If you have high levels of antithyroglobulin antibodies in your blood, it may be a sign of serious autoimmune disorder, such as Graves' disease or Hashimoto thyroiditis.

In some cases, you may have antithyroglobulin antibodies in your blood without any specific complications. If you test positive for these antibodies, and your doctor can't identify an underlying cause, they may monitor you for emerging health problems.

Anti-Thyroid Peroxidase Antibody
An anti-thyroid microsomal antibody test is also called a thyroid peroxidase test. It measures anti-thyroid microsomal antibodies in your blood. Your body produces these antibodies when cells in your thyroid become damaged. If you have an autoimmune disease or thyroid disorder, your antibody levels may rise. A positive test indicates an abnormal result and may be due to a variety of conditions, including:

- Hashimoto's thyroiditis, which is a swelling of the thyroid gland that often results in reduced thyroid function
- Graves' disease, which is an autoimmune disorder in which the thyroid gland is overactive
- Granulomatous thyroiditis, or subacute thyroiditis, which is a swelling of the thyroid gland that usually follows an upper respiratory infection
- Autoimmune hemolytic anemia, which is a drop in the number of red blood cells due to increased destruction by the immune system
- nontoxic nodular goiter, which is an enlargement of the thyroid gland with cysts called nodules
- Sjogren's syndrome, which is an autoimmune disorder in which the glands that produce tears and saliva are damaged
- Systemic lupus erythematosus, which is a long-term autoimmune disorder affecting your skin, joints, kidneys, brain, and other organs
- Rheumatoid arthritis
- Thyroid cancer

- Women with high levels of anti-thyroid microsomal antibodies have a higher risk of:
- Miscarriage
- Preeclampsia
- Premature birth
- Difficulty with in vitro fertilization

Having anti-thyroid antibodies in your blood doesn't automatically mean you have a thyroid disease. However, you may be at increased risk for future thyroid disease, and your doctor may want to monitor your condition. For unknown reasons, the risk tends to be higher in women.

Calcitonin
The calcitonin test is primarily used to help diagnose C-cell hyperplasia and medullary thyroid cancer, to evaluate the effectiveness of treatment, and to monitor those affected for recurrence. It is also ordered to screen for medullary thyroid cancer in family members of people with multiple endocrine neoplasia type 2 (MEN 2). C-cell hyperplasia and medullary thyroid cancer are two rare conditions in which excessive amounts of calcitonin are produced. C-cell hyperplasia is a benign condition that may or may not progress to become medullary thyroid cancer.

A low level of calcitonin means that it is unlikely that symptoms are due to C-cell hyperplasia or medullary thyroid cancer. An elevated concentration of calcitonin means that excessive amounts are being produced. Significantly elevated levels of calcitonin are a good indicator of C-cell hyperplasia or medullary thyroid cancer; however, the healthcare practitioner will use other procedures, such as a thyroid, scan, biopsy and ultrasound, to establish the diagnosis.

With successful treatment for medullary thyroid cancer, which may involve removal of the thyroid gland and often some surrounding tissues, calcitonin levels will usually fall to very low levels. If the values stay low over time, then it is likely that the treatment was effective. In some cases, calcitonin levels will fall but remain moderately elevated after treatment. This means that some calcitonin-producing tissue remains. Healthcare practitioners will monitor calcitonin and watch for increases over time. If calcitonin levels begin to rise, then it is likely that there is a recurrence of medullary thyroid cancer.

With medullary thyroid cancer and C-cell hyperplasia, other thyroid tests, such as T4, T3, and TSH, are usually normal while calcitonin levels are elevated.
Calcitonin levels may also be elevated with lung, breast, and pancreatic cancers, insulinomas (tumor in the pancreas that produces too much insulin), and rare pancreatic tumors called VIPomas (cancer that usually grows from islet cells in the pancreas).

Concentrations of calcitonin may be increased with use of drugs such as epinephrine, glucagon, and oral contraceptives, and are normally higher in newborns as well as in women during pregnancy.

Other conditions with elevated calcitonin include: Intestinal, gastric, or bronchial carcinoid tumors, chronic renal failure, Zollinger-Ellison syndrome, and pernicious anemia.

rT3, Reverse T3
This is a competitive inhibitor to T3 and T4. Leptin resistance is directly correlated with reverse T3. Leptin is a hormone that controls all of the energy metabolism in the body. It controls all the other hormones in the body as well. If it is not working well, the rest of your hormones are going to show clinical problems as well. Many people think they have thyroid issues when they actually have leptin resistance. One becomes leptin resistant when the brain no longer recognizes the leptin signal sent from our fat cells. Testing leptin is easy to do but rarely done in medicine today. Biochemically it can be done with the reverse T3 test. Leptin resistance completely turns off your thyroid gland making it so you cannot burn fat in your muscles because it regulates your basal metabolic rate.

T3, Free (Free Triiodothyronine)
Measures the free, unbound levels of the hormone triiodothyronine – the active thyroid hormone at the cellular level. Because the free levels of T3 represent immediately available hormones, free T3 is thought to better reflect the patient's hormonal status than total T3.

Elevated Free T3 – Elevated Free T3 may be indicative of hyperthyroidism.

Low Free T3 – Low Free T3 levels below the reference range may be indicative of hypothyroidism.

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If your pituitary gland is constantly bombarding your thyroid with high TSH levels, it kicks the thyroid into overdrive, and your thyroid starts producing too much T3 & T4 hormones. This is what causes the condition known as “hyperthyroidism”.

When the thyroid does not produce enough thyroid hormones, the pituitary detects this reduction in thyroid hormones, and it tries to stimulate the thyroid into action by producing and sending over more TSH. This is the pituitary gland’s effort to return the TSH levels to “normal” and balance the thyroid’s function. Therefore, higher TSH levels than normal suggests a thyroid that is under-active and not doing its job of producing thyroid hormone. So, in general, higher levels of thyroid stimulating hormone equals an under-active thyroid; or hypothyroidism.

And the opposite is true. If the thyroid is overactive and producing too much thyroid hormone, the pituitary senses that there is a thyroid hormone overload circulating through the system.

The pituitary then usually slows or shuts down thyroid stimulation, so that the thyroid will slow down its production of the T3 & T4 hormones. This drop in TSH is the pituitary gland’s attempt to return circulating T3 & T4 hormone levels to normal. Therefore, the TSH test results will show lower than normal TSH when the thyroid is overactive. So, in general, lower TSH levels equals an overactive thyroid; or hyperthyroidism.

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- preeclampsia
- premature birth
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TOXICITIES

ALLERGIES / POLLENS

Pollen is the fine powder that comes from the stamen of flowering plants, and it is often called hay fever, which is caused when pollen is dispersed through the air.

Pollen is fine, and can be carried great distances through the air. It also is easily inhaled as it comes in contact with your nose, mouth and nasal passages.

Pollen allergies can trigger allergic reactions, which affect the sinus and respiratory tract of those with this allergy. Symptoms can include watery eyes, runny nose, rhinitis, sore throat, coughing, increased mucus, headaches and asthma.

One of the best ways to combat pollen allergies is to understand which pollen you are allergic to. An allergist is able to easily test you for various types of trees, weeds, and grasses, and provide you with a list of pollons that affect you adversely.

Below is a list of what is included in the Allergies / Pollen Vitals Report:

- ☐ Grasses:
- ☐ Bermuda
- ☐ Johnson
- ☐ Orchard
- ☐ Rye
- ☐ Sweet Vernal
- ☐ Timothy
- ☐ Trees:
- ☐ Alder
- ☐ Arizona Cypress
- ☐ Ash
- ☐ Beech
- ☐ Birch
- ☐ Box
- ☐ Elder Cedar
- ☐ Cottonwood
- ☐ Date Palm
- ☐ Elm
- ☐ Hickory
- ☐ Juniper
- ☐ Maple
- ☐ Mountain Cedar
- ☐ Mulberry
- ☐ Oak
- ☐ Pecan
- ☐ Phoenix Palm
- ☐ Red Maple
- ☐ Silver Maple
- ☐ Sycamore
- ☐ Walnut
- ☐ Willow
- ☐ Weeds:
- ☐ English Plantain English Plantain
- ☐ Lamb’s Quarters
- ☐ Pigweed
- ☐ Ragweed
- ☐ Sagebrush
- ☐ Thistle

- ☐ Tumbleweed
- ☐ Dust:
- ☐ House
- ☐ Wood
- ☐ Fish:
- ☐ Fresh Water
- ☐ Salt Water
- ☐ Shellfish
- ☐ Animal Dander

Depending on where you live, your individual sensitivity may differ dramatically. If a person lives in a geographic area that has hot, dry, windy days, then there is more of a chance that pollen is in the air.

ALLERGY / SENSITIVITY

Food intolerance is a detrimental reaction, often delayed, to a food, beverage, food additive, or compound found in foods that produces symptoms in one or more body organs and systems, but generally refers to reactions other than food allergy. Food hypersensitivity is used to refer broadly to both food intolerances and food allergies.
Food allergies are immune reactions, typically an IgE reaction caused by the release of histamine but also encompassing non-IgE immune responses. This mechanism causes allergies to typically give an immediate reaction (a few minutes to a few hours) to foods.

Food intolerances can be classified according to their mechanism. Intolerance can result from the absence of specific chemicals or enzymes needed to digest a food substance, as in hereditary fructose intolerance. It may be a result of an abnormality in the body's ability to absorb nutrients, as occurs in fructose malabsorption. Food intolerance reactions can occur to naturally occurring chemicals in foods, as in salicylate sensitivity. Drugs sourced from plants, such as aspirin, can also cause these kinds of reactions.

Reactions to chemical components of the diet are more common than true food allergies. They are caused by various organic chemicals occurring naturally in a wide variety of foods, both of animal and vegetable origin more often than to food additives, preservatives, colorings and flavorings, such as sulfites or dyes. Both natural and artificial ingredients may cause adverse reactions in sensitive people if consumed in sufficient amounts, the degree of sensitivity varying between individuals.

Pharmacological responses to naturally occurring compounds in food, or chemical intolerance, can occur in individuals from both allergic and non-allergic family backgrounds. Symptoms may begin at any age, and may develop quickly or slowly. Triggers may range from a viral infection or

illness to environmental chemical exposure. It occurs more commonly in women, which may be because of hormone differences, as many food chemicals mimic hormones.
A deficiency in digestive enzymes can also cause some types of food intolerances. Lactose intolerance is a result of the body not producing sufficient lactase to digest the lactose in milk; dairy foods which are lower in lactose, such as cheese, are less likely to trigger a reaction in this case. Another carbohydrate intolerance caused by enzyme deficiency is hereditary fructose intolerance.

Celiac disease, an autoimmune disorder caused by an immune response to the protein gluten, results in gluten intolerance and can lead to temporary lactose intolerance. The most widely distributed naturally occurring food chemical capable of provoking reactions is salicylate, although tartrazine and benzoic acid are well recognized in susceptible individuals. Benzoates and salicylates occur naturally in many foods, including fruits, juices, vegetables, spices, herbs, nuts, tea, wines, and coffee. Salicylate sensitivity causes reactions to not only aspirin and NSAIDs but also foods in which salicylates naturally occur, such as cherries.
Other natural chemicals which commonly cause reactions and cross reactivity include amines, nitrates, sulphites and some antioxidants. Chemicals involved in aroma and flavor are often suspect.
The classification or avoidance of foods based on botanical families bears no relationship to their chemical content and is not relevant in the management of food intolerance.

Salicylate-containing foods include apples, citrus fruits, strawberries, tomatoes, and wine, while reactions to chocolate, cheese, bananas, avocado, tomato or wine point to amines as the likely food chemical. Thus, exclusion of single foods does not necessarily identify the chemical responsible as several chemicals can be present in a food, the patient may be sensitive to multiple food chemicals and reaction more likely to occur when foods containing the triggering substance are eaten in a combined quantity that exceeds the patient's sensitivity thresholds. People with food sensitivities have different sensitivity thresholds, and so more sensitive people will react to much smaller amounts of the substance.
Below is a list of what is included in the Allergies / Pollen Vitals Report:

- ☐ Food
- ☐ Corn
- ☐ Eggs
- ☐ Gelatin
- ☐ Milk
- ☐ Grains
- ☐ Barley
- ☐ Gluten
- ☐ Oats
- ☐ Rye
- ☐ Wheat
- ☐ Meat
- ☐ Beef

- ☐ Chicken
- ☐ Lamb
- ☐ Pork
- ☐ Nuts
- ☐ Almonds
- ☐ Brazil
- ☐ Peanuts
- ☐ Pecans
- ☐ Pine
- ☐ Walnuts
- ☐ Seeds
- ☐ Poppy
- ☐ Sesame
- ☐ Sunflower
- ☐ Spice
- ☐ Caraway
- ☐ Coriander
- ☐ Garlic
- ☐ Mustard

BACTERIAL DISEASES

Bacterial Diseases
These include any type of illness caused by bacteria. Bacteria are a type of microorganism, which are tiny forms of life that can only be seen with a microscope.

Babesia Genus (1-15)
This is a malaria-like parasite, also called a “piroplasm,” that infects red blood cells. Scientists believe Babesia microti is the most common piroplasm infecting humans, but they have identified over twenty piroplasms carried by ticks. In addition to transmission by a tick, babesia can be transmitted from mother to unborn child or through a contaminated blood transfusion.

Currently, most blood banks do not screen donated blood for babesia.
The first case of babesiosis was reported from Nantucket Island, Massachusetts, in 1969. Since the late 1980s, the disease has spread from the islands off the New England coast to the mainland. Cases have also been reported across the United States, Europe, and Asia.

Symptoms of babesiosis are similar to those of Lyme disease but babesiosis more often starts with a high fever and chills. As the infection progresses, patients may develop fatigue, headache, drenching sweats, muscle aches, chest pain, hip pain and shortness of breath ("air hunger"). Babesiosis is often so mild it is not noticed but can be life-threatening to people with no spleen, the elderly, and people with weak immune systems. Complications include very low blood pressure, liver problems, severe hemolytic anemia (a breakdown of red blood cells), and kidney failure.

Species in the genus borrelia are highly specialized, spiral-shaped, two-membrane bacteria that have two flagella. They live primarily as an extracellular pathogen aided in adapting to various host animals by regulating the various lipoproteins on their surface. Borrelia is extremely difficult to culture in vitro, due to its specific nutritional requirements.

Bacillus Anthracis
This is the etiologic agent of anthrax-a common disease of livestock and, occasionally, of humans-and the only obligate pathogen within the genus Bacillus. B. anthracis is a Gram-positive, endospore-forming, rod-shaped bacterium, with a width of 1.0-1.2 μm and a length of 3-5 μm.

Bordetella Genus (1-39)
These are small (0.2 – 0.7 μm), Gram-negative coccobacilli of the phylum Proteobacteria. Bordetella species, with the exception of B. petrii, are obligate aerobes, as well as highly fastidious, or difficult to culture. All species can infect humans. The first three species to be described (B. pertussis, B. parapertussis, B. bronchiseptica,) are sometimes referred to as the 'classical species'. One of these (B. bronchiseptica) is also motile.

B. pertussis and occasionally B. parapertussis cause pertussis or whooping cough in humans, and some B. parapertussisstrains can colonize sheep. B. bronchiseptica rarely infects healthy humans, though disease in immunocompromised patients has been reported. B. bronchiseptica causes several diseases in other mammals, including kennel cough and atrophic rhinitis in dogs and pigs, respectively. Other members of the genus cause similar diseases in other mammals, and in birds (B. hinzii, B. avium).

Bordetella Pertussis
This is a Gram-negative, aerobic, pathogenic, encapsulated coccobacilli of the genus Bordetella, and the causative agent of pertussis or whooping cough…. Its virulence factors include pertussis toxin, filamentous hæmagglutinin, pertactin, fimbria, and tracheal cytotoxin.

Borrelia
The various species of Borrelia are known to humans in the form of Lyme disease and recurring fever, transmitted through tick or flea bite. The cycle of Borrelia through animals is related to the tick's life cycle. The tick has four stages in its two-year life cycle, egg, larva, nymph and adult. Between each stage the tick needs a blood meal in order to mature. The tick usually acquires

the spirochaete during its larval stage, when it feeds on small animals such as rodents or birds. Usually the tick picks up Borrelia from the white-footed mouse, which is commonly infected. The tick then becomes the host for the spirochete. The bacteria resides in the digestive tract of the host for its next nymph and adult stages during which it is passed on to other animals, and sometimes humans.

Lyme disease (named for the town in which it was first identified) can be caused by any number of different species in the genus Borrelia, such as: B. andersonii, B. japonica, B. valaisiana, B. lusitanie, B. turdae. B. tunakii, B. bissettii, and B. lonestari.

Borrelia inhabits the lumen of a tick's digestive tract. The disease is transmitted to humans from a tick bite when the bacteria migrates up to the tick's salivary glands, and through the opening created by the tick. Ticks increase salivation during gorging, prompting the migration of the saliva from the digestive tract. Because migration from the gut takes a few days, transmission of the disease usually does not happen until after the first 24 hours of attachment.

During early stages of the disease the bacteria is localized in the skin and manifests itself as a characteristic bulls-eye rash, called Erythema Migrans (not in all cases, some people develop no rash). If the disease is caught in this stage and treated, further complications can be avoided. If the disease is not treated, symptoms can include arthritis, cranial neuropathy (specifically facial palsy), and meningitis (abnormal cerebrospinal fluid).

Recurring fever as the result of tick or flea bites have also been traced back to species of the genus Borrelia. More than 20 Borrelia species have been linked with recurring fever, among these is Borrelia recurrentis, which is transmitted by flea bite.

Borrelia (other 1-20)

Borrelia Burgdorferi (lyme)
This is a bacterial species of the spirochete class of the genus Borrelia. B. burgdorferi exists in North America and Europe and is the predominant causative agent of Lyme disease in the United States. Known for the "bullseye" rash.

Brucella
Brucellosis is an infectious disease caused by a type of bacteria called Brucella. The bacteria can spread from animals to humans. There are several different strains of Brucella bacteria. Some types are seen in cows. Others occur in dogs, pigs, sheep, goats, and camels. Recently, scientists have seen new strains in the red fox and certain marine animals, including seals. Brucella in animals cannot be cured.

Brucellosis is rare in the U.S. because of effective animal disease control programs. Fewer than 200 people get sick with the disease each year in the U.S. It is most often seen in the spring and summer months.

Campylobacter Jejuni (C. jejuni)
This infection causes diarrhea, which may be watery or sticky and can contain blood (usually occult) and fecal leukocytes (white cells). Other symptoms often present are fever, abdominal pain, nausea, headache and muscle pain. The illness usually occurs 2-5 days after ingestion of the contaminated food or water.

Chlamydia Psittaci
This is a lethal intracellular bacterial species that may cause endemic avian chlamydiosis, epizootic outbreaks in mammals, and respiratory psittacosis in humans.

Clostridium Botulinum
This is a Gram-positive, rod-shaped, anaerobic, spore-forming, motile bacterium with the ability to produce the neurotoxin botulinum.

Clostridium Difficile (C. difficile)
This is a bacterium that causes diarrhea and more serious intestinal conditions such as colitis.

Clostridium Perfringens (C. perfringens)
This is a spore-forming gram-positive bacterium that is found in many environmental sources as well as in the intestines of humans and animals.

Corynebacterium Diphtheriae
This is a nonmotile, non capsulated, club-shaped, Gram-positive bacillus. Toxigenic strains are lysogenic for one of a family of coryne bacteriophages that carry the structural gene for diphtheria toxin, tox.

E. Coli
This is a bacterium commonly found in the intestines of humans and other animals, where it usually causes no harm. Some strains can cause severe food poisoning, especially in old people and children.

Enterococcus Faecalis / Faecium
is a Gram-positive, commensal bacterium inhabiting the gastrointestinal tracts of humans and other mammals. Like other species in the genus Enterococcus, E. faecalis can cause life-threatening infections in humans, especially in the nosocomial (hospital) environment, where the naturally high levels of antibiotic resistance found in E. faecalis contribute to its pathogenicity. E. faecalis has been frequently found in re-infected root canal-treated teeth in prevalence values ranging from 30% to 90% of the cases.

Francisella Tularensis (Tularemia)

This is a disease of animals and humans. Rabbits, hares, and rodents are especially susceptible and often die in large numbers during outbreaks. Humans can become infected through several routes, including tick and deer fly bites.

Haemophilus Influenzae
This is a type of bacteria that mainly causes illness in babies and young children. These bacteria can cause infections in people of all ages ranging from mild, such as an ear infection, to severe, such as a bloodstream infection. In spite of the name, H. influenzae do not cause influenza (the “flu”).

Helicobacter Pylori (h. pylori)
This can enter your body and live in your digestive tract. After many years, they can cause sores, called ulcers, in the lining of your stomach or the upper part of your small intestine. For some people, an infection can lead to stomach cancer. Infection with H. pylori is common. About two-thirds of the world’s population has it in their bodies. For most people, it doesn’t cause ulcers or any other symptoms. After H. pylori enters your body, it attacks the lining of your stomach, which usually protects you from the acid your body uses to digest food. Once the bacteria have done enough damage, acid can get through the lining, which leads to ulcers. These may bleed, cause infections, or keep food from moving through your digestive tract. You can get H. pylori from food, water, or utensils. The germs live in the body for years before symptoms start, but most people who have it will never get ulcers.

Legionella Pneumophila (legionellosis)
This is a respiratory disease caused by Legionella bacteria. Sometimes the bacteria cause a serious type of pneumonia (lung infection) called Legionnaires’ disease.

Leptospira Interrogans
This is a Gram negative, obligate aerobe spirochete, with periplasmic flagella. When viewed through a light microscope, it often resembles a question mark, and this gives the species its name. It is a member of the genusLeptospira.

Listeria Monocytogenes
This is the species of pathogenic bacteria that causes the infection listeriosis. It is a facultative anaerobic bacterium, capable of surviving in the presence or absence of oxygen.

Lyme
This is an infectious disease caused by bacteria of the Borrelia type which is spread by ticks. The most common sign of infection is an expanding area of redness on the skin, known as erythema migrans, that begins at the site of a tick bite about a week after it has occurred. The rash is typically neither itchy nor painful. Approximately 25–50% of infected people do not develop a rash. Other early symptoms may include fever, headache and feeling tired.If untreated, symptoms may include loss of the ability to move one or both sides of the face, joint pains, severe headaches with neck stiffness, or heart palpitations, among others. Months to years later, repeated episodes of joint pain and swelling may occur. Occasionally, people

develop shooting pains or tingling in their arms and legs. Despite appropriate treatment, about 10 to 20% of people develop joint pains, memory problems, and feel tired for at least six months.

MRSA
This is methicillin-resistant Staphylococcus aureus, a type of staph bacteria that is resistant to several antibiotics. In the general community, MRSA most often causes skin infections. In some cases, it causes pneumonia (lung infection) and other issues. If left untreated, MRSA infections can become severe and cause sepsis–a life-threatening reaction to severe infection in the body. In a healthcare setting, such as a hospital or nursing home, MRSA can cause severe problems such as bloodstream infections, pneumonia and surgical site infections.

Mycobacterium Tuberculosis
This is an obligate pathogenic bacterial species in the family Mycobacteriaceae and the causative agent of tuberculosis.

Mycoplasma Genus (1-5)
This is a genus of bacteria that lack a cell wall around their cell membrane. Without a cell wall, they are unaffected by many common antibiotics such as penicillin or other beta-lactam antibiotics that target cell wall synthesis. They can be parasitic or saprotrophic. Several species are pathogenic in humans, including M. pneumoniae, which is an important cause of atypical pneumonia and other respiratory disorders, and M. genitalium, which is believed to be involved in pelvic inflammatory diseases. Mycoplasma species are the smallest bacterial cells yet discovered.

Neisseria Meningitidis
This is often referred to as meningococcus, is a Gram-negative bacterium that can cause meningitis and other forms of meningococcal disease such as meningococcemia, a life-threatening sepsis.

Pseudomonas Aeruginosa
Serious infections from P. aeruginosa generally occur only in healthcare (nosocomial) settings, but people can also develop mild infections in other environments.

Rickettsia Rickettsii
This is the small, aerobic gram-negative bacterium that is the cause of Rocky Mountain spotted fever in humans (and other vertebrates).

Salmonella infection (salmonellosis)
This is a bacterial disease of the intestinal tract Salmonella is a group of bacteria that causes typhoid fever, food poisoning, gastroenteritis, enteric fever and other illnesses. People become infected mostly through contaminated water or foods, especially meat, poultry and eggs.

Shigella Sonnei
This is a non-motile, non-spore-forming, facultative anaerobic Gram-negative bacterium. Its non-motile characteristic means that this species doesn't have flagella to facilitate its movement like many other human enterobacteria.

Staphylococcus Aureus
Staphylococcus (sometimes called "staph") is a group of bacteria that can cause a multitude of diseases. Staph infections may cause disease due to direct infection or due to the production of toxins by the bacteria.

Streptococcus Group A (group A strep)
This is a type of bacterium that can cause many different infections that range from minor illnesses to very serious and deadly diseases.

Streptococcus Group B (group B strep)
This is a common bacterium often carried in your intestines or lower genital tract. Group B strep is usually harmless in adults. In newborns, however, it can cause a serious illness known as group B strep disease.

Ureaplasma Genus (1-2)
Ureaplasma biovars, Ureaplasma urealyticum and Ureaplasma parvum, are now designated as separate species. Separation of these species is not possible except via molecular techniques such as polymerase chain reaction (PCR). Therefore, they are now considered together as Ureaplasma species. U parvum is generally the most common species detected in various clinical specimens but U urealyticum is apparently more pathogenic in conditions such as male urethritis. This differential pathogenicity at the species level has not been shown consistently for other disease conditions.

FUNGUS

There are over 40 different species of Candida Yeast, however, only a handful are harmful to us. These are the types that interact with humans. Chronic out of balance candida and other forms of gut dysbiosis can lead to "leaky gut" syndrome which is very simply, the inflammation and weakening of the intestinal walls.

The Candida cells, which are relatively benign in their yeast form, adopt their fungal form and begin to grow hyphae – the long branches that grow out of the fungus. These branches invade the cells in your intestinal lining, creating inflammation and permeating the membrane that prevents substances from leaking out.

This condition is characterized by leaky wall of the guts that makes it possible for different substances to penetrate into the body such as microbes, undigested foods, toxins and many

others. They are supposed to stay inside the gut, but when they penetrate the body, they can cause dangerous health disorders.

The most common disorders caused by leaky gut are: obesity, schizophrenia, type 1 and 2 diabetes, irritable bowel syndrome, celiac disease, Chrohn's disease and rheumatoid arthritis. The digestion is the first affected by leaky gut which is manifested as inflammatory gut disease like ulcerous colitis or irritable bowel syndrome.

Moreover, it can be manifested as allergy or sensitivity to some ingredients and as a result of that, it can cause pain and other digestive problems.

Leaky gut can also result in stiffness, pain and difficulty moving. You can experience pain in other parts of your body as well due to a leaky gut. This disorder can also cause psoriasis and eczema, but it can be manifested as rosacea acne as well. Leaky gut can weaken your immune system which will lead to constant colds and sinus infections. It affects your brain as well, and people who have experienced this disorder, report a feeling of tiredness, anxiety and depression.

If you experience some of the above mentioned symptoms, make sure to consult your doctor and do the necessary tests to discover whether you are dealing with leaky gut syndrome or not.

Make sure to avoid the consumption of sugar, lactose and gluten since they are considered to be the heaviest food that trigger leaky gut disorder. Instead, you should consume coconut products, fermented foods such as pickles and veggies, bone marrow soup and raw dairy products.

Nowadays, people are under a lot of stress which is the main factor for all kinds of health issues because it weakens your immune system which can lead to leaky gut.

In order to relieve stress, try to exercise more, spend some quality time with people you love, meditate or write a personal diary.

Candida Albicans
This species is the most common species of yeast in our bodies. It lives in our digestive tract and on our skin. Normally it lives in our bodies in a commensal relationship with us meaning we both benefit from each other. However, candida albicans overgrowth can occur which results in infection most commonly in the genital area and the mouth.

Candida Glabrata
This once thought to be harmless species is now causing yeast infections in those with compromised immune systems such as those with AIDS. It usually infects the urogenital tract and the blood stream. The mortality rate is high with this species.

Candida Krusei
This species is used in the chocolate making process and is usually harmless to humans. However, in those with compromised immune systems and those with types of blood cancer and can cause dangerous yeast infections.

Candida Lusitaniae
This species was first identified to cause a yeast infection in 1979 but very few cases were reported until recently with wide use of procedures such as chemotherapy and bone marrow transplants which leaves humans open to infection by this species.

Candida Parapsilosis
This is another species that is common to our bodies and it is the most common species found on our hands. However, this yeast can infect open wounds and surgical patients.

Candida Stellatoidea
This a form of candida albicans with a mutated sucrase gene creating an inability to assimilate sucrose.

Candida Tropicalis
A species of mitosporic fungi that is a major cause of septicemia and disseminated candidiasis especially in patients with lymphoma, leukemia and diabetes mellitus. It is also found as part of the normal human mucocutaneous flora.

Cryptococcus Gattii
Cryptococcus gattii causes the human diseases of pulmonary cryptococcosis (lung infection), basal meningitis, and cerebral cryptococcomas. Occasionally, the fungus is associated with skin, soft tissue, lymph node, bone, and joint infections.

Mucormycosis
This is any fungal infection caused by fungi in the order Mucorales. Generally, species in the Mucor,Rhizopus, Absidia, and Cunninghamella genera are most often implicated.

The disease is often characterized by hyphae growing in and around blood vessels and can be potentially life-threatening in diabetic or severely immunocompromised individuals.

Pneumocystis Jiroveci
This is a yeast-like fungus of the genus Pneumocystis.

Sporotrichosis
Widespread infectious disease marked by nodules or ulcers of the skin, chiefly affecting humans and domestic mammals and caused by the fungus Sporothrix schenckii.

Talaromyces

This is a genus of fungi in the family Trichocomaceae. Described in 1955 by American mycologist Chester Ray Benjamin, species in the genus form soft, cottony fruit bodies (ascocarps) with cell walls made of tightly interwoven hyphae. The fruit bodies are often yellowish or are surrounded by yellowish granules. A 2008 estimate placed 42 species in the genus, but several new species have since been described.

Tinea Corporis
This is a superficial fungal infection (dermatophytosis) of the arms and legs, especially on glabrous skin; however, it may occur on any part of the body.

Signs and Symptoms

It may have a variety of appearances; most easily identifiable are the enlarging raised red rings with a central area of clearing (ringworm). The same appearance of ringworm may also occur on the scalp (tinea capitis), beard area (tinea barbae) or the groin (tinea cruris, known as jock itch or dhobi itch).

Other classic features of tinea corporis include:

- The edge of the rash appears elevated and is scaly to touch.
- Sometimes the skin surrounding the rash may be dry and flaky.
- Almost invariably, there will be hair loss in areas of the infection.

Tinea Unguium (Onychomycosis)
This is a fungal infection of the nail. This condition may affect toenails or fingernails, but toenail infections are particularly common.

HUMAN TOXINS

Alcohol
Excessive alcohol use can cause the pancreas to produce toxic substances that interfere with proper functioning. The resulting inflammation is called pancreatitis, a serious problem that can destroy the pancreas. One of the most frequent causes of chronic pancreatitis is alcohol abuse. The liver's job is to break down harmful substances, including alcohol. Excessive drinking can cause alcoholic hepatitis which can lead to the development of jaundice (yellowing of the skin and eyes).

Chronic liver inflammation can lead to severe scarring known as cirrhosis. This formation of scar tissue can destroy the liver. When the liver fails to perform, toxic substances remain in your

body. Alcoholic liver disease is the liver manifestation of alcohol overconsumption, including fatty liver (buildup of fat in the liver. Its normal to have fat in your liver, however more than 5 – 10 % is not normal and you may have fatty liver), alcoholic hepatitis (an inflammatory condition of the liver because of drinking too much alcohol for a very long time), and chronic hepatitis (inflammation of the liver) with liver fibrosis (the first stage of liver scarring,)or cirrhosis(which is scar tissue that replaces the normal tissue of the liver).

When the pancreas and liver don't function properly, the risk of hypoglycemia (low blood sugar) rises. A damaged pancreas can cause the body to be unable to utilize sugar due to a lack of insulin, which can lead to hyperglycemia. Unbalanced blood sugar levels can be a dangerous problem, especially for people with diabetes.

Drinking also releases excess GABA and dopamine, two naturally occurring neurotransmitters. GABA is responsible for calming the brain down, and dopamine is responsible for pleasure, a part of the brain's reward system. Too much of these neurotransmitters can lead to shortness of breath, high blood pressure, increased heart rate, night terrors, delusions, hallucinations, spasms, and increased levels of both aggression and depression.

Chemical Toxicity

According to the United States Environmental Protection Agency or EPA, the most important threat to both human, animal and plant life on earth comes from the effects of toxic chemicals. Hundreds of thousands of chemicals have been produced in the world in the past two hundred years, especially, often with little understanding of their toxicity – until a problem arises. Thousands of toxic chemicals have found their way into our air, food and water supplies worldwide. No place on earth is free of them anymore because they are carried by the wind and the rain to every corner of the earth. Studies reveal that everyone in the developed nations has hundreds of these toxic chemicals in their blood and stored in their body tissues. Toxic chemicals contribute to every possible type of physical and mental health problem imaginable.

One important group of chemicals, the endocrine disruptors. These are toxic chemicals that disrupt the hormone systems of plants, animals and human beings. Most people have at least a dozen of these inside the body, and many people today are born with them, having acquired them from your mother in utero.

If you get enough of these chemicals in your body, they can wreak havoc on your hormones due to the following mechanisms:

- Increasing production of certain hormones
- Decreasing production of other hormones
- Imitating hormones
- Turning one hormone into another
- Interfering with hormone signaling
- Telling cells to die prematurely
- Competing with essential nutrients

- Binding to essential hormones
- Accumulating in organs that produce hormones.

Some of the worst are:

- BPA. This chemical mimics estrogen in the body.
- Dioxin. This is a pesticide sprayed on some food products.
- Atrazine. This is a toxic herbicide sprayed on some food products, especially corn.
- Phthalates. This is another toxic chemical that can signal cells to die. It is found in some plastic food containers, some personal care products, and food wrap that says recycle #3.
- Perchlorate. This chemical is sometimes used to kill germs that live in tap water. It interferes with iodine in the body.
- Other iodine antagonists. Other chemicals that interfere with iodine in the body and thereby cause thyroid problems are bromine and fluorine.
- Fire retardants (PBDEs). These are very persistent chemicals that imitate thyroid hormones and contribute to thyroid problems.
- Perfluorinated chemicals. These are chemicals used to make non-stick coatings on pots and water-resistant coatings for clothing. They are very persistent chemicals that have many negative effects on the body including kidney and thyroid disease, low birth weight, damaged sperm and high cholesterol. Most people have some in their bodies because they do not degrade.
- Organophosphates. These are very toxic pesticides used to stop insect reproduction.
- Glycol ethers. These are endocrine-disrupting chemicals found in solvents used in paints, brake fluid, cleaning products and cosmetics. They can cause asthma, allergies and blood abnormalities, among other problems.
- Arsenic, lead, copper and mercury. These toxic metals are also considered endocrine disruptors. Copper and mercury affect the thyroid gland. Lead and arsenic – widely used in pesticides – can affect many glands in the body.
- Medical drugs in the water. Unfortunately, some medical and over-the-counter drugs do not break down or biodegrade quickly.

Drugs, Medication

A person with drug toxicity has accumulated too much medication in the bloodstream. The effects of the medication are more pronounced at toxic levels, and side effects may be severe. Toxicity may result when the dose is too high, or it may result when the liver or kidneys are unable to remove the drug from the bloodstream. Many commonly prescribed medications can accumulate in the bloodstream and result in toxicity.

Symptoms of drug toxicity depend on the drug taken. Symptoms of drug toxicity can be broken down into: Symptoms of GHB abuse which include: palpitations, confusion, lethargy, coma, low blood pressure, low body temperature, muscle spasms, slow breathing, slow heart rate,

vomiting, violent behavior. Others include symptoms of hallucinogens, symptoms of narcotics, symptoms or sedatives, and symptoms of stimulants.

Drugs, Recreational
Recreational drugs are chemical substances that are taken for enjoyment instead of medical reasons. Psychedelic Mushrooms, Amphetamines, Ecstasy, Cocaine, Opium, Heroin and Cannabis are just some of recreational drugs out there. They can lead to addiction, health and social problems and crime. Most recreational drugs are illegal.

Electromagnetic Radiation
This is a kind of radiation including visible light, radio waves, gamma rays, and X-rays, in which electric and magnetic fields vary simultaneously. Sunlight is also a form of EM energy, but visible light is only a small portion of the EM spectrum, which contains a broad range of electromagnetic wavelengths. The study of electromagnetism deals with how electrically charged particles interact with each other and with magnetic fields.

There are four main electromagnetic interactions:

1. The force of attraction or repulsion between electric charges is inversely proportional to the square of the distance between them.
2. Magnetic poles come in pairs that attract and repel each other, much as electric charges do.
3. An electric current in a wire produces a magnetic field whose direction depends on the direction of the current.
4. A moving electric field produces a magnetic field, and vice versa.

EM radiation is created when an atomic particle, such as an electron, is accelerated by an electric field, causing it to move. The movement produces oscillating electric and magnetic fields, which travel at right angles to each other in a bundle of light energy called a photon. Photons travel in harmonic waves at the fastest speed possible in the universe: 186,282 miles per second (299,792,458 meters per second) in a vacuum, also known as the speed of light. The waves have certain characteristics, given as frequency, wavelength or energy.

Excitotoxins
Excitotoxins are a class of chemicals (usually amino acids) that overstimulate neuron receptors. Neuron receptors allow brain cells to communicate with each other, but when they're exposed to excitotoxins, they fire impulses at such a rapid rate that they become exhausted. Several hours later, these depleted neurons die. Excitotoxins can cross the placental barrier, possibly harming the brains of unborn children. Excitotoxins also cross the blood brain barrier and are known to cause migraines, seizures, neurological disorders, blurred vision, increased appetite, overeating, infertility and reproductive disorders, impaired brain function, cancer, and heart and cardiovascular damage.

Excitotoxicity is the pathological process by which nerve cells are damaged or killed by excessive stimulation by neurotransmitters such as glutamate and similar substances. This occurs when receptors for the excitatory neurotransmitter glutamate (glutamate receptors) such as the NMDA receptor and AMPA receptor are overactivated by glutamatergic storm. Excitotoxins like NMDA and kainic acid which bind to these receptors, as well as pathologically high levels of glutamate, can cause excitotoxicity by allowing high levels of calcium ions (Ca^{2+}) to enter the cell. calcium ions enter into cells activates several enzymes, including phospholipases, endonucleases, and proteases such as calpain. These enzymes go on to damage cell structures such as components of the cytoskeleton, membrane, and DNA. Examples of excitotoxins include: aspartame (NutraSweet), sucralose, cysteine, hydrolyzed protein, aspartic acid and food coloring. MSG is one of the worst and is disguised under at least 30 other names which include: autolyzed yeast, calcium caseinate, gelatin, glutamate, glutamic acid, hydrolyzed protein, monopotassium glutamate, monosodium glutamate, sodium caseinate, textured protein, yeast extract, yeast food, and yeast nutrient.

Hair Dyes

In certain individuals, the use of hair coloring can result in allergic reactions and/or skin irritation. Individuals allergic to gluten for example, will need to be cautious when purchasing hair color since certain hair dye includes gluten. Gluten does not need to be ingested for it to cause an allergy. Skin contact with gluten may cause a reaction; therefore, leading to an allergy. Symptoms of these reactions can include redness, sores, itching, burning sensation and discomfort. Symptoms will sometimes not be apparent immediately following the application and processing of the tint, but can also arise after hours or even a day later.

Herbicide Toxicity

Although many modern herbicides are less toxic than their predecessors, they are still poisons and should always be handled with caution.Skin irritations are some of the most common effects when a person comes into contact with herbicides, and are most likely to happen on exposed areas, such as the hands and forearms. Some chemicals may burn the skin and should be washed off immediately with cold water.

Glyphosate, the active ingredient in Monsanto's Roundup herbicide, is possibly "the most important factor in the development of multiple chronic diseases and conditions that have become prevalent in Westernized societies." Glyphosate residues are found in most commonly consumed foods in the Western diet courtesy of GM sugar, corn, soy, and wheat.

Research suggests that glyphosate may "enhance the damaging effects of other food-borne chemical residues and toxins in the environment to disrupt normal body functions [including gut bacteria] and induce disease." Glyphosate causes extreme disruption of the microbe's function and lifecycle. What's worse, glyphosate preferentially affects beneficial bacteria, allowing pathogens to overgrow and take over, including the highly toxic Clostridium botulinum.

Glyphosate may stimulate hormone-dependent cancers even at extremely low "environmentally relevant" amounts.

Metabolic Waste

Metabolic toxins (or body toxins) are normal by-products of your metabolism occurring throughout the mind and body. Organic chemist Ludwig Brieger defined a toxin as a poisonous substance produced within living cells or organisms. This excluded manufactured substances (chemical) created by artificial processes. Simply put, metabolic toxins are toxic waste byproducts produced throughout every metabolic pathway in the mind and body that must be eliminated from the body. Numerous factors may contribute toward an excess of metabolic toxins. However, the two most common factors today include:

1. Nutrient imbalances

   Nutrient imbalances include nutrient excesses and deficiencies, inherited enzyme deficits, toxic elements, chemical toxicants, medications, stress, and so on. Metabolic toxins can produce a long list of symptoms and conditions throughout the mind and body.

   Each metabolic pathway (urea cycle, citric acid cycle, carbohydrate metabolism, neurotransmitter metabolism, etc.) requires a specific combination and proper amount of essential nutrients (or derivatives) during each step of the process.

   If there is a deficiency or excess of any of the nutrients required for the specific metabolic pathway, the pathway is not completed in an efficient manner and results in an excess of a metabolic toxin. In any pathway, combinations of essential nutrients may be synthesized to produce additional metabolites required for the metabolic pathway to function properly.

   Metabolic toxins produce a variety of metabolic intermediates known as organic acids. A urinary organic acids lab analysis is a functional analysis. This simply means the organic acids analysis can be helpful for determining whether a sufficient amount of a particular nutrient is available for a variety of metabolic pathways. If a particular nutrient is deficient, it produces specific metabolic intermediates or metabolic toxins.

2. Sugar and simple carbohydrates

   Sugar, in its variety of incognito names such as high fructose corn syrup, agave, aspartame, and so on, are the most common contributors for metabolic toxins. Sugar also contributes toward nutrient imbalances further increasing metabolic toxins. Simply put, sugar is poison to the mind and body.
   Simple carbohydrates such as refined flour (white bread, pasta, white rice, etc.) are all major contributors.

Paint

This is any liquid, liquefiable, or mastic composition that, after application to a substrate in a thin layer, converts to a solid film. It is most commonly used to protect, color, or provide texture to objects. Paint can be made or purchased in many colors—and in many different types, such as watercolor, synthetic, etc. Paint is typically stored, sold, and applied as a liquid, but most types dry into a solid.

Pesticide Toxicity

Pesticide poisoning symptoms are similar to those of other illnesses and poisonings. Unfortunately, all pesticide poisoning symptoms are not the same. Each chemical family (i.e., organophosphates, carbamates, chlorinated hydrocarbons) can attack the human body in a different way. However, you should be aware of the general symptoms of pesticide poisoning.

- Mild Poisoning or Early Symptoms of Acute Poisoning include: headache, fatigue, weakness, dizziness, restlessness, nervousness, perspiration, nausea, diarrhea, loss of appetite, loss of weight, thirst, moodiness, soreness in joints, skin irritation, eye irritation, irritation of the nose and throat.
- Moderate Poisoning or Early Symptoms of Acute Poisoning: nausea, diarrhea, excessive saliva, stomach cramps, excessive perspiration, trembling, no muscle coordination, muscle twitches, extreme weakness, mental confusion, blurred vision, difficulty in breathing, cough, rapid pulse, flushed or yellow skin, weeping.
- Severe or Acute Poisoning: fever, intense thirst, increased rate of breathing, vomiting, uncontrollable muscle twitches, pinpoint pupils, convulsions, inability to breathe, unconsciousness.

Smog Pollution

Exposure to smog can lead to several different types of short-term health problems due to its ozone content. These include:

- Coughing and throat or chest irritation: High levels of ozone can irritate your respiratory system, generally lasting for a few hours after you've been exposed to smog. However, ozone can continue to harm your lungs even after symptoms disappear.
- Worsening of asthma symptoms: If you suffer from asthma, exposure to high levels of ozone from smog can trigger asthma attacks.
- Difficulty breathing and lung damage: Smog can make it feel difficult to breathe deeply, especially during exercise, according to the Mayo Clinic. This is because of the effects of ozone on lung function.
- It's important to note that smog affects everyone differently, and some people are more susceptible to its negative effects. Children, seniors, and people with asthma need to be especially careful on smoggy days.

Smoke

This is a collection of airborne solid and liquid particulates and gasses emitted when a material undergoes combustion or pyrolysis, together with the quantity of air that is entrained or otherwise mixed into the mass. It is commonly an unwanted by-product of fires (including

stoves, candles, oil lamps, and fireplaces), but may also be used for pest control (fumigation), communication (smoke signals), defensive and offensive capabilities in the military (smoke screen), cooking, or smoking(tobacco, cannabis, etc.). Smoke is used in rituals where incense, sage, or resin is burned to produce a smell for spiritual purposes. Smoke is sometimes used as a flavoring agent, and preservative for various foodstuffs. Smoke is also a component of internal combustion engine exhaust gas, particularly diesel exhaust.

Stimulants

This is an overarching term that covers many drugs including those that increase activity of the body, drugs that are pleasurable and invigorating, or drugs that have sympathomimetic effects. The term stimulant encompasses a broad category of substances, including those prescribed for medical conditions; those manufactured for illicit substance abuse; and those found in over-the-counter (OTC) decongestants, herbal extracts, caffeinated beverages, and cigarettes. The symptoms of a sublethal stimulant overdose may include dizziness, tremor, irritability, confusion, hostility, hallucinations, panic, headache, skin flushing, chest pain, palpitations, cardiac arrhythmias, hypertension, vomiting, cramps, and excessive sweating.

Stress Hormones

This includes cortisol and adrenaline which are produced by your adrenal glands. Adrenaline known as the “stress hormone” helps regulate blood pressure and the immune system during a crisis, whether a physical attack or an emotional setback. This helps you to tap into your energy reserves and increases your ability to fight off infection. Relentless stress can keep this survival mechanism churning in high gear, subverting the hormone’s good intentions. Stress hormones are produced by your body in situations that might be perceived as potentially dangerous. Daily activities, physical and emotional, that cause increased anxiety may cause your body to release some of these hormones and may cause you to feel more stressed about a routine situation. Stress hormones are a normal body response, but when constantly under stress caused from daily situations, this can lead to long-term health problems. Long-term stress is associated with high levels of cortisol. This is a steroid hormone secreted by the adrenal cortex which has a marked effect on carbohydrate metabolism and acts as an immunosuppressant. In the short term, physiological and psychological arousal results in the secretion of adrenaline into the blood, and noradrenaline into tissues. These hormones evolved so that we could deal rapidly with impending danger. They prepare our bodies for action by improving the blood supply to skeletal muscles and mobilizing energy stores. If stress hormones are too low, muscles have insufficient fuel and oxygen to respond quickly.

Tobacco/Nicotine

Nicotine is naturally found in the roots and leaves of various plants especially those of the nightshade family. It is most commonly found in tobacco. Many people don’t know this but nicotine is very toxic, sometimes even more than cocaine and so it is highly controlled and regulated by the government. As little as 60mg of the substrate is enough to kill a person. To achieve a lethal dose from cigarettes, for instance, one must smoke about 40 cigarettes at once or chew about 15 pieces of nicotine gum at once. Once smoked, chewed, or sniffed nicotine goes into the bloodstream, and the body wants more. The nicotine in tobacco makes it a drug.

Because nicotine is a stimulant, it speeds up the nervous system, creating the feeling of having more energy. It also makes the heart beat faster and raises blood pressure.

Vaccinations
Information is from these sites:

http://www.healthline.com/health/alcohol/effects-on-body
http://www.quitalcohol.com/the-truth-about-what-alcohol-does-to-your-body.html
https://www.fda.gov/drugs/resourcesforyou/consumers/ucm143566.htm
http://www.livescience.com/38169-electromagnetism.html
http://www.prevention.com/mind-body/how-lower-cortisol-manage-stress
https://quitday.org/smoking-effects/nicotine-poisoning/
http://healthliteracy.worlded.org/docs/tobacco/Unit1/1what_is.html

MINERALS: HEAVY METALS

Aluminum
According to the CDC, the average adult in the US consumes about seven to nine mg of aluminum per day in food, and a lesser amount from air and water. Only about one percent of the aluminum you ingest orally gets absorbed into your body-the rest is moved out by your digestive tract, provided it's functioning well. Aluminum is found in a shocking number of foods and consumer products, including:

- Foods such as baking powder, self rising flour, salt, baby formula, coffee creamers, baked goods and processed foods, coloring and caking agents.
- Drugs, such as antacids, analgesics, anti-diarrheals, and others; additives such as magnesium stearate
- Vaccines-Hepatitis A and B, Hib, DTaP (diphtheria, tetanus, pertussis), pneumococcal vaccine, Gardasil (HPV), and others.
- Cosmetics and personal care products such as antiperspirants, deodorants (including salt crystals, made of alum), lotions, sunscreens, and shampoos.

Aluminum products, including foil, cans, juice pouches, tins, and water bottles. Aluminum is to your central nervous system as cigarette smoke is to your lungs. Scientists are clear that toxic metals damage brain tissue and lead to degenerative disease by producing oxidative stress with aluminum being one of the worst offenders. Once aluminum is in your tissues, your body has a difficult time releasing it. In the body it travels around by piggybacking on your iron transport system. It crosses biological barriers that normally keep other types of toxins out, such as your blood-brain barrier. Over time, aluminum can accumulate in your brain and do serious damage to your neurological health-regardless of your age.

Removing mercury from vaccines and replacing it with aluminum may be increasing the problems from BOTH toxins in your body. The reason for this is because aluminum impairs your

body's ability to excrete mercury by impeding your glutathione production. Glutathione is your most important intracellular detoxifier, required for reversing oxidative stress. So, if your aluminum load is high, your body will potentially become more toxic from the mercury from, say, flu shots and fish because you are now on "aluminum overload" and your detoxification system no longer functions well.

The best way to protect yourself is to be careful about your choices in food and personal products, and minimize your use of vaccines and other drugs that are often contaminated with aluminum.

Antimony

Antimony toxicity occurs either due to occupational exposure or during therapy. Occupational exposure may cause respiratory irritation, pneumoconiosis, antimony spots on the skin and gastrointestinal symptoms. In addition, antimony trioxide is possibly carcinogenic to humans. Because antimony is found naturally in the environment, the general population is exposed to low levels of it every day, primarily in food, drinking water, and air. Exposure to antimony at high levels can result in a variety of adverse health effects. Breathing high levels for a long time can irritate the eyes and lungs and can cause heart and lung problems, stomach pain and ulcers, diarrhea, and vomiting.

Arsenic

Arsenic is a heavy metal which is a natural component of the earth's crust. It exists in compounds that may be organic or inorganic. It is highly toxic in its inorganic form. Poisoning can occur by ingestion, inhalation and dermal absorption. Elemental arsenic is the least toxic. Trivalent arsenic is well absorbed through the skin and is 60 times more toxic than pentavalent arsenic, which is well absorbed by the gut. Arsine gas is highly toxic. Regular exposure leads to cancer and other toxic health effects, including cardiovascular disease, skin hyperpigmentation, keratoses, neurological problems, and developmental disorders. Toxicity is due to arsenic's effect on many cell enzymes, which affect metabolism and DNA repair. Arsenic poisoning symptoms begin with nausea, vomiting, abdominal pain, and severe diarrhea. Arsenic is excreted in urine but can also accumulate in many body tissues.

Barium

Barium carbonate is relatively insoluble in water, it is toxic to humans because it is soluble in the gastrointestinal tract. Barium is a soft, silvery-white metal. It is an active metal, reacting with air, water, acids and bases. Because it is insoluble in the body, barium sulfate is used as an x-ray tracer for the stomach and intestines. Barium is also used in drilling fluids for oil exploration, as well as in paints, fireworks (where it produces a green color), glass and rubber making. It is also used in water softeners, desiccants and rodent poisons. Barium It is never found in nature as a free element. Barium exposure can happen through a number of channels including occupational exposure, groundwater contamination, environmental pollution, cigarette smoke, and certain medical procedures as mentioned above. Industrial use of Barium is perhaps of the largest concern due to the potential for massive environmental pollution.

Bismuth
While many people will tell you that bismuth is non-toxic in small amounts, sufficient exposure can produce nausea, headache, diarrhea, and pain. According to the Department of Physiology at the University of Tübingen in Germany, anemia is another potential negative side effect of exposure to bismuth and caution is advised when taking any medication containing bismuth. Certain metals are known to reduce sperm metabolism and contribute to infertility in men. Bismuth has been suspected to be one of those metals.

It is a naturally occurring metal used to manufacture solder, fishing anchors, shotgun pellets, and more. It is found naturally in very small amounts in some foods and its sulfide and oxide compounds are important for use in cosmetics and medicines. Bismuth is not available as a supplement because it is not essential to your body. Bismuth doesn't provide any nutritional benefits directly, although it can be of help with gastrointestinal disorders, which is why it is used in brand-name products such as Pepto-Bismol and Kaopectate but consuming too much bismuth can lead to side effects, so consult with your doctor before using it.

Cadmium
This is an extremely toxic metal commonly found in industrial workplaces. It is of no use to the human body and is toxic even at low levels. The negative effects of cadmium on the body are numerous and can impact nearly all systems in the body, including cardiovascular, reproductive, the kidneys, eyes, and even the brain. Exposure can occur if you smoke cigarettes or breathe second- or third-hand cigarette smoke. You can be exposed if you eat foods that contain high levels of cadmium, such as shellfish, liver, and kidney meats. Other foods that contain cadmium are grain cereal products, potatoes, and some leafy vegetables. Cadmium has a very detrimental effect on the central nervous system, including decreased attention and memory in humans. This is likely because cadmium induces neuron cell death. Neurons are brain cells that communicate and transmit information, if they are affected, so is brain function. Cadmium is well-known to cross the placenta and to accumulate in fetal tissues. Prenatal exposure is a threat to the developing brain and results in reduced birth weight and birth size.

Chromium
Chromium hexavalent is a carcinogen that attacks your lungs when inhaled and has been connected to sinus, nasal, and lung cancer. Exposure has been linked to immunity disorders, neuropsychiatric disorders, atherosclerosis, neurodegenerative disorders, congenital disorders, DNA damage, and disruption of bodily processes. In Russia, exposure to chromium hexavalent is widely blamed for premature senility.

Chromate dusts and acids can permanently damage your eyes if they come into direct contact, and other kinds of skin contact may lead to allergic dermatitis, corrosion, skin irritation, sensitization, and even ulcers.

Chromium hexavalent is extremely reactive with vitamin C. When exposure is coupled with vitamin C in the body, it can result in severe damage to DNA inside the lung's cells. However, outside of the cells, vitamin C actually serves to protect against the damage to the cells. Small

amounts of chromium in one form is actually good for people. It makes insulin work better and helps our metabolism.

Cobalt
Cobalt can accumulate to toxic levels in the liver, kidney, pancreas, and heart, as well as the skeleton and skeletal muscle. Cobalt has been found to produce tumors in animals and is likely a human carcinogen as well. Cobalt is a naturally occurring element that does have beneficial applications. For instance, cobalt is an essential component of vitamin B12. Cobalt has been added to pigments to produce a distinct blue color. Lithium ion batteries contain cobalt. In the medical field, cobalt-60 is used in radiotherapy and for sterilizing medical equipment. Hip replacements are also made of cobalt. A deficiency of cobalt, which is very rare, can lead to pernicious anemia.

Industrial plants may leak cobalt and other toxic metals into the environment. Once cobalt particles enter the atmosphere, they settle to the ground and enter the food and water supply; most of the population is exposed to cobalt through food, water, and air. Cobalt makes its way through the environment and cannot be destroyed.

Copper
Copper Toxicity is a condition that is increasingly common in this day and age, due to the widespread occurrence of copper in our food, copper fungicides, e-cigs, Copper IUDs, hot water pipes, along with the common nutritional deficiencies in Zinc, Manganese and other trace minerals that help keep levels of Copper in balance.

Birth control pills increase a woman's risk of having a Copper toxicity condition due to the effect that estrogen has on the body, increasing copper retention in the kidneys. Estrogen stimulates similar receptors to Aldosterone receptors in the kidneys, increasing Sodium, Copper and water retention. Both estrogens and Aldosterone can increase swelling, Cyst formation, increasing the blood volume which can cause hypertension, stroke, or death if the Liver and Adrenal glands are not able to regulate these hormones in the body.

Copper builds up in the soft tissues of Liver and disrupts the Liver's metabolic abilities to detoxify and cleanse the blood in general. Copper toxicity in the liver is therefore disrupting the Liver's Glucuronidation pathway, that helps to eliminate excessive amounts of Estrogen by making it water soluble. Other toxic heavy metals like Lead, Mercury, Aluminum, and Cadmium will also build up in the Soft tissues, as a result of Copper competing with Zinc in many enzymes and binding sites in the body.

When Zinc gets displaced by Copper, there will be a reduction in Metallothionein production, which is the main heavy metal binding protein in the body. The production of the body's main detoxifying agent and antioxidant, Glutathione, will also decline when too much Copper gets stored in the Liver organ's tissues.

Other sources of chemicals which mimic estrogen, known as xeno-estrogens, may also increase the retention of copper. These include pesticides, plastic bags, Volatile organic compounds (VOC's), growth hormones used on animals, and all petrochemical waste products used in the manufacturing of plastic, gasoline and other petrochemical derivatives. These are all referred to as Xeno-estrogens.

Copper is a very stimulating mineral to the nerves and nervous system. Copper increases the production of epinephrine, norepinephrine, and dopamine while also implicated in a decrease of histamine. These effects on neurotransmitter levels can give rise to many psychological imbalances such as mood swings, depression, mental agitation, feeling over-stimulated, restlessness, anxiety, insomnia and a racing mind with too many thoughts are all hallmarks of elevated Copper toxicity.

Elevated Copper in the body acts like caffeine or even amphetamines. It constantly keeps the conversion of dopamine into norepinephrine going so that you have a constant adrenaline rush to help you be on the go, but you also are unable to settle down or turn off your mind.

Copper toxicity symptoms:

- Acne
- Allergies
- Hair loss
- Anemia
- Anorexia
- Anxiety
- Attention deficit disorder
- Arthritis
- Asthma
- Autism
- Candida overgrowth
- Depression
- Dysmenorrhea
- Male infertility
- Prostatitis
- Fibromyalgia
- Migraine Headaches
- PMS
- Chronic infections
- Insomnia
- Racing thoughts
- Neuralgia (nerve pain)
- Sciatica
- Hypertension
- Hypothyroidism
- Schizophrenia

- Bipolar (Manic Depression)

Copper is a necessary component in the manufacturing of ATP (Adenosine triphosphate) which is cellular energy. Low levels of Copper are associated with chronic fatigue. When someone has a Copper toxicity condition, they will most likely also have a concurrent Copper deficiency due to a bio-unavailability.

Gold

Gold Toxicity is the toxic effect of gold that occurs when gold is administered to the body. It is usually given for rheumatoid arthritis (RA), juvenile rheumatoid arthritis (JRA), or psoriatic arthritis.

Gold is generally administered to reduce joint pain and joint swelling. In many, gold treatment helps in decreasing joint deformity and joint disability. Although, in about 50% of the individuals, the injections may not be an effective treatment tool. Individuals with the genotype HLA-DR3 have a higher risk for gold therapy-induced Gold Toxicity. In such individuals, kidney toxicity and platelet dysfunction may occur. Gold Toxicity long-term effects may include liver inflammation, blue-grey skin color, and mouth ulcers. There can also be bone marrow suppression resulting in frequent infections. Stopping or discontinuing the use of gold therapy is the first line of treatment for Gold Toxicity. The treatment for arthritis using gold may be resumed, if the side effects improve and go away. The prognosis of Gold Toxicity is generally good with appropriate early diagnosis and treatment including stoppage of the causative gold therapy.

Iron

The body normally absorbs less iron if its stores are full, but some individuals are poorly defended against iron toxicity. Once considered rare, iron overload has emerged as an important disorder of iron metabolism.
Iron overload is known as hemochromatosis and usually is caused by a gene that enhances iron absorption. Other causes of iron overload include repeated blood transfusions, massive doses of dietary iron and rare metabolic disorders. Additionally, long-term overconsumption of iron may cause hemosiderosis, a condition characterized by large deposits of the iron storage protein hemosiderin in the liver and other tissues.

Iron overload is most often diagnosed when tissue damage occurs, especially in iron-storing organs such as the liver. Infections are likely to develop because bacteria thrive on iron-rich blood. Ironically, some of the signs of iron overload are analogous to those of iron deficiency: fatigue, headache, irritability and lowered work performance. Therefore, taking supplements before measuring iron status is clearly unwise.

Other common symptoms of iron overload include enlarged liver, skin pigmentation, lethargy, joint diseases, loss of body hair, amenorrhea and impotence. Untreated hemochromatosis aggravates the risks of diabetes, liver cancer, heart disease and arthritis.

In the United States, an estimated 10 percent of the population is in positive iron balance, with 1 percent having iron overload. Iron overload is more common in men than women and is twice as prevalent in men as iron deficiency. Some researchers have expressed concern about the widespread iron fortification of foods. Such fortification does make it hard for people with hemochromatosis to follow a low-iron diet but equal dangers lie in indiscriminate use of iron supplements.

Bloodletting is the best treatment for hemochromatosis along with following a low-iron diet designed by a certified nutritionist containing substances that interfere with iron absorption. Some examples of substances that block iron absorption in such a diet include black tea, phytic acid found in whole grains, taking calcium with meals containing iron, and reducing vitamin C intake.

Lead

Lead is a highly toxic metal and a very strong poison. Lead poisoning is a serious and sometimes fatal condition. It occurs when lead builds up in the body.

Lead is found in lead-based paints, including paint on the walls of old houses and toys. It is also found in:

- art supplies
- contaminated dust
- gasoline products sold outside of the United States and Canada

Lead poisoning usually occurs over a period of months or years. It can cause severe mental and physical impairment. Young children are most vulnerable.

Children get lead in their bodies by putting the lead containing objects in their mouths. Touching the lead and then putting their fingers in their mouths may also poison them. Lead is more harmful to children because their brains and nervous systems are still developing.

Lead poisoning can be treated, but any damage caused cannot be reversed.

Symptoms of lead poisoning are varied. They may affect many parts of the body. Most of the time, lead poisoning builds up slowly. It follows repeated exposures to small quantities of lead.

Lead toxicity is rare after a single exposure or ingestion of lead.

Signs of repeated lead exposure include:

- abdominal pain
- abdominal cramps
- aggressive behavior
- constipation
- sleep problems
- headaches

- irritability
- loss of developmental skills in children
- loss of appetite
- fatigue
- high blood pressure
- numbness or tingling in the extremities
- memory loss
- anemia
- kidney dysfunction

Since a child's brain is still developing, lead can lead to intellectual disability. Symptoms may include:

- behavior problems
- low IQ
- poor grades at school
- problems with hearing
- short- and long-term learning difficulties
- growth delays

A high, toxic dose of lead poisoning may result in emergency symptoms. These include:

- severe abdominal pain and cramping
- vomiting
- muscle weakness
- stumbling when walking
- seizures
- coma
- encephalopathy, which manifests as confusion, coma, and seizures

Lithium

Acute toxicity occurs when you swallow too much of a lithium prescription at one time. Chronic toxicity occurs when you slowly take a little too much lithium prescription every day for a while. This is actually quite easy to do, because dehydration, other medicines, and other conditions can easily affect how your body handles lithium. These factors can make the lithium build up to harmful levels in your body. Acute chronic toxicity occurs when you normally take lithium every day for bipolar disorder, but one day you take an extra amount. This can be as little as a couple of pills or as much as a whole bottle.

Lithium is sold under various brand names, including: Cibalith, Carbolith, Duralith, Eskalith, Lithane, Lithobid, Lithonate.

Lithium is also commonly found in batteries, lubricants, high performance metal alloys, and soldering supplies. This article focuses only on medicine.

Acute Toxicity

Common symptoms of taking too much lithium at one time include: Diarrhea, Dizziness, Nausea, Stomach pains, Vomiting, Weakness

Depending on how much lithium was taken, a person may also have some of the following nervous system symptoms: Coma (decreased level of consciousness, lack of responsiveness), Hand tremors, Lack of coordination of arms and legs, Muscle twitches, Seizures, Slurred speech, Uncontrollable eye movement, Heart problems may occur in rare cases.

Chronic Toxicity
There will likely not be any stomach or intestinal symptoms. Symptoms that can occur include: Increased reflexes, Slurred speech, Uncontrolled shaking (tremors)
In severe cases of chronic toxicity, there may also be nervous system and kidney problems, such as: Kidney failure, Memory problems, Movement disorders, Problems keeping salts in your body, and Psychosis (disturbed thought processes, unpredictable behavior).

Manganese
The human body contains approximately ten milligrams (10mg) of manganese, most of which is found in the liver, bones, and kidneys. This trace element is a cofactor for a number of important enzymes. Manganese metabolism is similar to that of iron. It is absorbed in the small intestines and while the absorption process is slow, the total absorption rate is exceptionally high – about 40%. Excess manganese is excreted in bile and pancreatic secretion. Only a small amount is excreted in the urine.

Excess manganese interferes with the absorption of dietary iron. Long-term exposure to excess levels may result in iron-deficiency anemia. Increased manganese intake impairs the activity of copper metallo-enzymes. Manganese overload is generally due to industrial pollution. Workers in the manganese processing industry are most at risk. Well water rich in manganese can be the cause of excessive manganese intake and can increase bacterial growth in water. Manganese poisoning has been found among workers in the battery manufacturing industry.

Symptoms of toxicity mimic those of Parkinson’s disease (tremors, stiff muscles) and excessive manganese intake can cause hypertension in patients older than 40. Significant rises in manganese concentrations have been found in patients with severe hepatitis and posthepatic cirrhosis, in dialysis patients and in patients suffering heart attacks.

Manganese influences the copper and iron metabolism and estrogen therapy may raise serum manganese concentration, whereas glucosteroids alter the manganese distribution in the body. Calcium deficiency increases manganese absorption. Elevated calcium and/or phosphorus intake suppress the body’s ability to absorb manganese, while an increase in Vitamin C improves cellular exchange.

Manganese overload is generally due to industrial pollution. Workers in the manganese processing industry are most at risk. Drinking water should be analyzed when manganese

toxicity is suspected. Long term parenteral nutrition has been associated with high blood concentrations of manganese in children who displayed symptoms of toxicity.

Dark hair dyes can contain manganese and thus falsely elevate hair levels. In the case of extremely high manganese levels obtained from scalp hair, pubic hair should be tested as a control.

Mercury

Mercury in any form is poisonous, with mercury toxicity most commonly affecting the neurologic, gastrointestinal (GI) and renal organ systems. Poisoning can result from mercury vapor inhalation, mercury ingestion, mercury injection, and absorption of mercury through the skin.

We get mercury in our bodies from many different sources including mercury vapors in ambient air, ingesting it via drinking water, fish, dental amalgams, vaccines, occupational exposures, home exposures including fluorescent light bulbs, thermostats, batteries, red tattoo dye, skin-lightening creams, over-the-counter products such as contact lens fluid and neosynephrine, and more.

You absorb about 80 percent of inhaled mercury vapor and nearly 100 percent of the mercury in fish through your gut.

Once this mercury is in your body it is then primarily distributed in the kidneys and brain and can be readily transferred to the fetus via the placenta.

The only way it can get out of your body is via urine, feces, expired air, and breast milk. The major reason it is toxic to human biology is because mercury has the ability to bind to sulfur-containing molecules in the body (found in nearly every enzyme and in the mitochondria), as well as other chemical binding sites in the cells.

The symptoms of mercury toxicity mimic many of the symptoms of autism. Higher levels of mercury have been shown to create symptoms that last up to 30 years! It aggravates every other medical condition.

The World Health Organization (WHO) admits that there are no safe levels of mercury exposure. Common exposure comes from vaccines, medications, coal emissions, dental amalgam fillings, and contaminated fish. Even in small amounts, mercury is dangerous.

The extent of mercury damage to the brain and heart depends on age, sex, and genetic factors. Infants, children, and the elderly are the most at risk. Males are also higher risk due to testosterone increasing mercury's neurotoxicity.

For more than 80 years, medical doctors have observed symptoms for those exposed to even very low levels of mercury.

Symptoms of mercury toxicity are:

- Excessive irritability/anger
- Timid behavior
- Depression
- Weakness
- Delirium
- Insomnia
- Apathy
- Impaired concentration
- Poor memory
- Abnormal motor coordination
- Suicidal tendencies
- Personality changes
- Obsessive compulsive disorder

SOME OF THE BIOLOGICAL EFFECTS OF MERCURY

- Can cause lifelong immune deficiency.
- Causes a loss of glutathione
- Resists removal of the pathogenic yeast Candida albicans
- Inactivates contacted molecules of glutathione two-fold.
- Reduces antioxidant levels
- Disrupts metabolism of creatine, causing poor muscle tone and weakness
- Renders the body defenseless against free radicals
- Interrupts protein synthesis
- Retards brain development by interfering with DNA and RNA function
- Depletes protein-bound sulfhydryl groups and lower the body's immunity
- Destroys glutamate transport proteins responsible for removing glutamate from neurons causing mis-wiring of the brain (often causing dementia and problems with motor control)
- Destroys enzyme functioning creating faulty wiring of the brain
- Promotes the production of inflammatory cytokines, which are essential in fighting viruses
- Disrupts protein digestion
- Can enter the area of the brain called the hypothalamus, which is responsible for metabolic function, hormonal balance-including neuro-hormones-hunger, thirst, body temperature, and the circadian rhythm affecting the sleep-wake cycle. An injured hypothalamus can cause lifelong suppression of the immune system, and weaken the adrenals and thyroid.
- Can inhibit neurotransmitters (the brain's messengers) such as serotonin, dopamine, and norepinephrine.
- Increases your body's lipid peroxidation. This is when the fatty membranes in our body are oxidized by free radical damage. This, first and foremost, affects organs with a high fat content, such as the brain. It weakens the cell membranes and

proteins within the cells. When this happens, enzymes are lost and cells cannot function.
- Increases susceptibility to seizures
- Renders the brain vulnerable to damage from excitotoxins

Nickel (Ni)
This is a nasty toxic metal and a known carcinogen. It is one of the metals we see most commonly in toxicity tests. It appears stuck onto DNA, stuck on to translocator protein and is often present in blood at high levels. Nickel is one of many carcinogenic metals known to be an environmental and occupational pollutant. The New York University School of Medicine warns that chronic exposure has been connected with increased risk of lung cancer, cardiovascular disease, neurological deficits, developmental deficits in childhood, and high blood pressure.

Nickel exposure introduces free radicals which lead to oxidative damage and may also affect the kidneys and liver. In 2012, Egypt's Ministry of Agriculture administered liver function tests to 25 nickel-plating workers. Results showed they overwhelmingly suffered from compromised liver function.

Researchers at Dominican University of California have linked nickel exposure to breast cancer. How? Well, nickel is believed to bind to estrogen receptors and mimic the actions of estrogen. It is well established that lifetime estrogen exposure is a breast cancer risk factor, and, unfortunately, even this "imposter estrogen" contributes to the risk. Additionally, nickel has been identified as a toxin that severely damages reproductive health and can lead to infertility, miscarriage, birth defects, and nervous system defects.

Phosphorous
Phosphorus is an essential nutrient for the body and is routinely consumed through food. After consumption, phosphorus is usually bound with oxygen and exists as phosphate in the body. Both organic and inorganic forms of phosphate are present in regularly consumed foods such as meats, fish, eggs, milk/dairy products and vegetables. The amount of total phosphate ingestion can be significantly influenced by processed food and/or beverage intake, as phosphate metabolites are used as additives in these items. Following a meal, inorganic phosphate can be rapidly absorbed across the small intestine and enter the bloodstream causing an elevation in blood phosphate levels. The net efficiency of intestinal phosphate absorption is more than twice that of calcium absorption. An increase in serum levels of inorganic phosphate usually reduce serum levels of ionic calcium by forming a calcium-phosphate complex; such reduced ionic calcium concentration in turn stimulates release of PTH (parathyroid hormone) in an attempt to restore the serum calcium balance.

Phosphate toxicity due to excessive retention of phosphate in the body can cause a wide range of cellular and tissue injuries (Figure 2). For instance, higher occurrence of vascular calcification, encountered in patients with CKD (chronic kidney disease), is related to the

increased retention of phosphate in the body [1,48]. Genetic studies with mice have shown that phosphate toxicity is closely associated with cardiovascular calcification. In humans, phosphate toxicity and low serum vitamin D levels have been implicated as independent risk factors for high mortality in CKD patients.

Platinum

Platinum is a nonessential element that can be found at elevated concentrations in urine with excessive exposure. Industrial workers exposed to Platinum showed higher concentrations in the blood and urine (> 2 Î¼g Platinum/24 hours) in comparison to non-exposed workers. Platinum is poorly absorbed in the gut but may be absorbed via inhalation. Since it is a relatively rare element, most Platinum exposures are of occupational origin. In recent years, there may have been a slight increase in environmental Platinum due to the use of Platinum as a catalyst in automobile exhaust converters. Platinum is a byproduct of copper refining and used as an alloy in dental and orthopedic materials. Symptoms of excess exposure to Platinum include: dermatitis, irritation of mucous membranes, shortness of breath and wheezing (for inhaled Platinum dusts or salts), development of chronic allergic reactions ("platinosis"), nephritis, and immune system suppression (from Platinum diamine salts). Platinum containing drugs, such as cisplatin and carboplatin, are used as chemotherapeutic agents. Such drugs are extremely toxic and cause nephrotoxicity with associated magnesium wasting and hypomagnesaemia (low magnesium), myelosuppression, inner ear toxicity, and neurotoxicity. Urinary Platinum can be significantly elevated for patients that have received the Platinum containing chemotherapeutic agents.

Selenium

The tolerable upper intake level, or UL, for selenium is 400 micrograms a day for adults; this includes the selenium you get from your daily diet. Supplemental selenium in excess of 100 micrograms can be harmful to your health, according to the Merck Manuals Online Medical Library. Early signs of selenium toxicity are a garlicky odor on your breath and a metallic taste in the mouth, according to the National Institutes of Health Office of Dietary Supplements. As toxicity progresses you'll likely notice fast hair loss and brittle nails, as well as other symptoms of selenosis such as nausea, vomiting, diarrhea, tiredness, irritability and skin rash. Selenium toxicity can also cause nerve damage. Selenium toxicity is not just attributed to taking high doses — it can with long-term use, explains the Linus Pauling Institute. If you develop any symptoms of selenium toxicity, discontinue use and speak to your doctor for a diagnosis.
Silver; Silver itself is not toxic to humans, but most silver salts are. In large doses, silver and compounds containing it can be absorbed into the circulatory system and become deposited in various body tissues, leading to argyria, which results in a blue-grayish pigmentation of the skin, eyes, and mucous membranes.

Silver Metal Poisoning Toxicity Symptomatology

- Direct effect on cartilages
- Direct effect on nerves and nerve sheaths
- Can Affect the brain/nervous system over time
- gradually softens tissues

- targets “intellectual” sections of the brain
- Slight changes to voluntary systems (undefined)
- May affect reasoning abilities
- Physical symptoms of neck and back pain, and tearing pain throughout body
- Mental fatigue and restlessness with vertigo
- Symptoms masked by coffee/caffeine intake
- Symptoms temporarily relieved by exercise
- Cold weather increases pain from Rheumatism
- Increased joint pain
- knotting of cartilage
- Affects left testes and right ovaries (hardening)
- Mental and emotional excitement to the point of rage
- Experience of shock sensations in the limbs upon going to sleep
- Skin irritation, itching sensation that cannot be relieved
- Painful tension in the throat
- Gray mucus from throat and sinuses
- Heart Palpitations while lying on the back

The above describes metallic silver poisoning. This illustrates the great importance of proper particle sizing in colloidal silver. Of course, the above applies to Metallic Silver in general. In addition, metallic silver stimulates the body to eliminate other heavy metals.

Silver
This is a chemical element with symbol Ag (from the Latin argentum, derived from the Proto-Indo-European $h_2erǵ$: “shiny” or “white”) and atomic number 47. A soft, white, lustrous transition metal, it exhibits the highest electrical conductivity, thermal conductivity, and reflectivity of any metal.
Other than in currency and as an investment medium (coins and bullion), silver is used in solar panels, water filtration, jewelry, ornaments, high-value tableware and utensils (hence the term silverware), in electrical contacts and conductors, in specialized mirrors, window coatings, in catalysis of chemical reactions, as a colorant in stained glass and in specialized confectionery. Its compounds are used in photographic and X-ray film. Dilute solutions of silver nitrate and other silver compounds are used as disinfectants and microbicides (oligodynamic effect), added to bandages and wound-dressings, catheters, and other medical instruments. Source

Thallium
This is a chemical element with symbol Tl and atomic number 81. It is a gray post-transition metal that is not found free in nature. When isolated, thallium resembles tin, but discolors when exposed to air.

Soluble thallium salts (many of which are nearly tasteless) are toxic, and they were historically used in rat poisons and insecticides. Use of these compounds has been restricted or banned in many countries, because of their nonselective toxicity. Thallium poisoning usually results in hair loss, although this characteristic symptom does not always surface.

Tin
This is a chemical element with the symbol Sn (from Latin: stannum) and atomic number 50. It is a post-transition metal in group 14 of the periodic table. It is obtained chiefly from the mineral cassiterite, which contains tin dioxide, SnO_2.

Zinc
This is a chemical element with symbol Zn and atomic number 30. It is the first element in group 12 of the periodic table. In some respects zinc is chemically similar to magnesium: both elements exhibit only one normal oxidation state (+2), and the Zn^{2+} and Mg^{2+} ions are of similar size. Zinc is the 24th most abundant element in Earth's crust and has five stable isotopes. The most common zinc ore is sphalerite (zinc blende), a zinc sulfide mineral.
Source

MOLDS

Many people still don't fully understand the health hazards of fungal exposure. The term toxic mold is somewhat misleading as it exudes an idea that certain molds are toxic, when actually certain types of molds produce secondary metabolites that produce toxins. The correct term is mycotoxins. Airborne mycotoxins can definitely destroy one's health. Sometimes, people are unaware that they are breathing mold spores and mycotoxins until they are very sick. Certain people have a minor allergic reaction to some molds, but once you leave the affected area they most likely recover with few serious side effects. However, if they have been exposed to the dangerous molds such as Stachybotrys or Chaetomium, they could suffer from a myriad of serious symptoms and illnesses such as chronic bronchitis, learning disabilities, mental deficiencies, heart problems, cancer, multiple sclerosis, chronic fatigue, lupus, fibromyalgia, rheumatoid arthritis, multiple chemical sensitivity, bleeding lungs and much more.
Mycotoxins can be present in spores and small mold fragments released into the air. Once the mold fragments, mycotoxins and spores are in the air, individuals may breathe them into their lungs. Symptoms of exposure to mycotoxins include coughing, wheezing, runny nose, irritated eyes or throat, skin rash and diarrhea. Since these symptoms are general in nature, they also can be caused by a cold, influenza or exposure to other allergens.

Acremonium
The presence of this slow-growing, prolific mold can be detected by its unpleasant stench in the air. Acremonium is potentially toxic if ingested. Individuals who are allergic to this fungus can experience nausea, vomiting and diarrhea. It can cause nail infections, corneal ulcers, endocarditis, and meningitis.

Alternaria
Alternaria is one of the most important allergenic molds found in the US. It is most common as an outdoor mold, as it thrives on various types of vegetation – including as the black rot commonly seen on tomato fruit (see above). Alternaria spores can be detected from Spring

through late Fall in most temperate areas, and can reach levels of thousands of spores per cubic meter of air. While one usually thinks of molds as a problem in damp or even wet conditions, Alternaria spores can be at their highest concentrations during dry, windy conditions that are ideal for the spores to become airborne.

Alternaria is one of the most common outdoor molds, but also has been found in the indoor environment. Alternaria is known to be a problem in allergic disease. In patients who show allergy to molds, up to 70% of those patients demonstrate allergy to Alternaria, and Alternaria is known to be a risk factor for asthma.

Aspergillus
This affects people who have become sensitized to Aspergillus sp., an inflammation of the respiratory airways. Aspergillosis should not be considered an allergy and is potentially fatal.

Chaetomium
Chaetomium spp. are among the fungi causing infections wholly referred to as Phaeohyphomycosis.Fatal deep mycoses due to Chaetomium Atrobrunneum have been documented. Brain abscess, peritonitis, cutaneous lesions and Onychomycosis may also develop due to exposure.

Unlike most other mold pathogens, there is medical evidence to suggest that people who are exposed to Chaetomium may be predisposed to permanent neurological damage of the myelin sheath. Therefore, a noticeably high incidence of autoimmune diseases have been linked to exposure of this mold such as Multiple Sclerosis, Lupus, etc. It has also been linked to certain forms of Cancer.

As with other fungal exposure, it can also cause permanent DNA damage. This has been documented in several cases being researched during studies. Chaetomium is the only mold that inhibits cell replication.

Chaetomium are found on a variety of substrates containing cellulose including paper and plant compost. Several species have been reported to play a major role in the decomposition of cellulose-made materials. These fungi are able to dissolve the cellulose fibers in cotton and paper and thus cause the materials to disintegrate. The process is especially rapid under moist conditions.

This fungus is reported to be allergenic and a toxin. On a scale of worst to more mild in effects on human health, contrary to what many believe; Chaetomium would be second or possibly third to Aspergillus only to Stachybotrys. Their Ascospores are brown or gray-olivaceous with one or two germ pores.

Cladosporium
If you have noticed a black pepper type substance growing in your toilet tank, it is most likely Cladosporium, the most common of all molds. It is categorized as Black Mold and the genus is

Cladosporium, which includes over 30 species. The differences can only be detected under a microscope.

Mold spores live indoors and outdoors, and are an airborne allergen. Cladosporium mold is commonly found, in dying and dead plants, in the soil and on food. It thrives in a damp, dark, nonporous environment such as window frames and the inside of refrigerators. It will also multiply in houses with poor ventilation and in straw roofs built in low damp areas. Samples from fuel tanks, face creams, paints and fabric reveal the presence of Cladosporium.

Since Cladosporium mold is airborne, it can be stubborn to get rid of. Most important is to treat the environment. The spores seem to be less active during the winter months (most likely due to the cold) but come spring, they return with force. Surfaces that appear moldy should be well-scrubbed with a bleach-containing product and wiped dry. Allergy-sensitive individuals should avoid any kind of contact with the mold.

Although Cladosporium mold is non-toxic to humans, all molds can be hazardous to your health, particularly affecting those with allergies, asthma and immune-compromised systems. Cladosporium is one of the molds that cause the most allergy symptoms, producing a positive skin reaction in allergy-sensitive individuals. In certain people, a high concentration of mold is not needed to trigger a reaction. Those most at risk to develop allergic reactions are infants, children, pregnant women, and the elderly.

Symptoms most common to Cladosporium mold are: congested or runny nose, sinus problems, red and watery eyes, skin irritation, fatigue, sore throat, cough and hoarseness. Over time, more serious symptoms may develop such as, ear inflammation; nose bleeds and joint pain, without swelling.

Fusarium
Fusarium is a hydrophilic mold that requires very wet conditions and is frequently isolated from plants and grains. They colonize in continuously damp materials such as damp wallboard and water reservoirs for humidifiers and drip pans.

While Fusarium Keratitis can be a serious infection, it is a rare disease.
Fusarium is commonly found in organic matter such as soil and plants. This infection cannot be transmitted from person to person.

People who have trauma to the eye, certain eye diseases and problems with their immune system may be at increased risk for these types of infection

Mucor
This is a fungus found world-wide, a tiny, black pin mold which is most often apparent on breads and bread products. Although it is typically discovered indoors, it can also grow in hay, soil,

stored seeds, and horse manure. Mucor mold can develop on plants and rotting fruits and vegetables. An accumulation of house dust in HVAC systems and poorly maintained carpeting can harbor mucor spores.

This type of mold is a most invasive organism, and responsible for the contamination of many kinds of stored food products. When the spore is inhaled or ingested, it can not only affect the respiratory system, but can also cause problems to the digestive tract as well. Workers whose occupations include exposure to wood chips and sawdust are susceptible to mucor allergies.

The colonies are very fast growing and their prevalence is of considerable economic concern in the field of food production and a substantial factor in the depletion of our healthcare dollars. Mucor is a harmful mold that can adversely affect the respiratory system. Exposure to constant high levels of mucor can cause or worsen the symptoms of asthma. Other symptoms include elevated temperature, flu-like symptoms, malaise, and difficulty breathing. Constant exposure to the spores can be extremely dangerous to those with weak immune systems. A severe reaction to mucor can cause mucormycosis or zygomycosis, and extrinsic allergic alveolitis.

Mucormycosis is a disease brought about by inhaling spores produced by mucor molds. The fungal infection typically causes a reaction in the eyes and nose, but the most common site for serious infection is the lungs, sinuses, and brain. In some cases, mucor invades arteries whereby blood clots can form, blocking vessels to the brain.

Penicillium

Although the genus penicillium has been isolated for the production of penicillin, which is deemed one of the most useful drugs of the 20th century, it is a most toxic mold to those sensitive to the mycotoxins it produces.

Characteristics of Penicillium

Penicillium mold commonly grows as a green, blue or white fuzzy substance on moist, nonliving organic matter, such as stale or decaying food. It presents its own adverse symptoms, which consist of gastric and/or respiratory problems. So the best rule of thumb is: when in doubt…throw it out!

Like all other molds, penicillium reproduces by means of tiny spores and develops wherever there is moisture, food and oxygen. At times, mold can be detected with the naked eye, but often it is invisible. You can find mold in soil, on plants, in the air, and on any organic and inorganic matter. Molds can either have a distinguishable smell or be odorless.

Rhizopus

Rhizopus is often isolated from soil and plant material, and some species can also be plant pathogens. It is commonly known as the bread mold and indoors it can be isolated from dust, wood pulp, food and food products.

Rhizopus species are among the fungi causing the group of infections referred to as zygomycosis. Zygomycosis is now the preferred term over mucormycosis for this angio – invasive disease. Rhizopus arrhizus is the most common cause of zygomycosis and is followed by Rhizopus microsporus var. rhizopodiformis.

Zygomycosis infection includes mucocutaneous, rhinocerebral, genitourinary, gastrointestinal, pulmonary, and disseminated infections. The most frequent predisposing factors for zygomycosis include diabetic ketoacidosis and immunosuppression due to various reasons, such as organ transplantation and other factors such as deferoxamine treatment, renal failure, extensive burns, trauma, and intravenous drug use which may also predispose to development of zygomycosis. Heatstroke has been described as a risk factor for disseminated zygomycosis as well.

Stachybotrys (Black Mold)
Stachybotrys, commonly called “stachy,” is a greenish-black, slimy mold found only on cellulose products (such as wood or paper) that have been wet for several days or more. The mold does not grow on concrete, linoleum or tile.

Toxic black mold can cause permanent damage to your health. In extreme cases, toxic black mold has even led to death. Because of the serious health effects toxic black mold can cause, if you find it in your home you need to take steps to get it removed immediately. The longer you are around toxic black mold, the more it will damage your health.

The trichothecene mycotoxins produced by toxic black mold are neurotoxic. This means they can kill neurons in the brain and impair a person’s mental ability. They also cause nervous disorders such as tremors and can cause personality changes such as mood swings and irritability.

Symptoms:
- Confusion
- Brain fog
- Shortened attention span
- Difficulty concentrating and paying attention
- Slowed reflexes
- Disorientation
- Dizziness
- Memory loss and memory problems
- Impaired learning ability
- Hallucinations
- Shock
- Anxiety
- Depression
- Aggression and other personality changes
- Tingling

- Trembling
- Shaking
- Seizure
- Numbness

People living in homes with toxic black mold are exposed mainly through breathing in toxic black mold spores and mycotoxins. Toxic black mold mycotoxins create irritation and a burning feeling in a person's air passages such as the nasal cavity, mouth and throat.

The mycotoxins can even become lodged in the mucus membranes, sinuses and the lungs which then causes a burning feeling, breathing problems and bleeding in the lungs.

Symptoms:

- Difficulty breathing – breathlessness or shortness of breath
- Wheezing
- Coughing
- Pulmonary edema – swelling of the lungs
- Pulmonary hemorrhage – bleeding in the lungs
- Sore throat
- Burning sensation of the mouth
- Bleeding gums
- Runny nose
- Itchy nose
- Stuffy, blocked nose
- Nose bleeds
- Circulatory Symptoms From Toxic Black Mold

Toxic black mold mycotoxins can be breathed in, ingested, or absorbed through a person's skin or eyes. Eventually the mycotoxins then find their way into the person's blood. This leads to heart damage, problems with blood clotting and internal or external hemorrhaging.

Symptoms:

- Irregular heartbeat
- Heart inflammation
- Damage to heart
- Low blood pressure
- Bone marrow disruption
- Bleeding tendency
- Blood not clotting properly
- Hemorrhage – internal bleeding
- Vomiting up blood
- Bleeding in the brain and in other organs
- Vision and Eye Symptoms From Toxic Black Mold

Toxic black mold mycotoxins that are in the air can enter a person's eyes. The mycotoxins are cytotoxic (toxic to cells) and when they come into contact with eye cells they cause inflamed and injured eyes and create vision problems.

Symptoms:

- Eye inflammation and soreness
- Red or bloodshot eyes
- Eye damage
- Blurry vision and vision worsening
- Jaundice (yellowing of the eyes)
- Skin Symptoms From Toxic Black Mold

Through the skin is one of the three main ways that toxic black mold mycotoxins enter the human body. There have been cases in the past where people have handled hay contaminated with toxic black mold and developed severe rashes and skin problems on their body where they touched the hay, as well as on sweaty areas like the armpits.

Symptoms:

- Crawling skin
- Dermatitis – skin inflammation, rash, blisters, itchiness
- Jaundice (yellowing of the skin)
- Immune System Symptoms From Toxic Black Mold

Toxic black mold puts out chemicals which suppress the immune system. In fact many immunosuppressive drugs are actually created from toxic molds. A person who is immunocompromised from being around toxic black mold will more easily get infections and illnesses.

Symptoms:

- Immunosuppression – immune system not functioning properly
- Infections recurring

Reproductive System Symptoms From Toxic Black Mold

Mycotoxins from toxic black mold are teratogenic. This means they can cause problems in the fetus during pregnancy which then leads to birth defects. Toxic black mold mycotoxins are also cytotoxic and mutagenic (cause cell mutations) and inhibit protein synthesis including DNA and RNA.

Symptoms:

- Infertility
- Miscarriage
- Impotence
- Fetal development problems

Tiredness and Discomfort Symptoms From Toxic Black Mold
When a person is around toxic black mold the immune system may release a sedative called Chloral Hydrate. This is used as a defense to try to slow down the effects of toxic black mold. But this also makes a person tired and causes fatigue. Toxic black mold can also cause soreness of the muscles and joints.

Symptoms:

- Chronic fatigue
- Drowsiness
- Weakness
- Aches and pains
- Muscle pain
- Chest pain
- Abdominal pain
- Joint pain
- Malaise – general discomfort
- Headaches
- Cold or flu type symptoms or recurring colds
- Fever
- Nausea
- Vomiting
- Diarrhea
- Other Symptoms From Toxic Black Mold

Symptoms:

- Hair Loss
- Weight loss, anorexia
- Hearing loss
- Liver disease
- Coma
- Death

Toxic Black Mold Causes Allergic Symptoms
Like other molds, toxic black mold is allergenic. The spores from toxic black mold cause allergic reactions such as breathing problems, sore eyes, runny nose, itchiness, sneezing and a sore throat.

Differing Toxic Black Mold Symptoms
Toxic black mold affects different people in different ways. Some people won't experience symptoms as severe as what others experience. Children, the elderly and people with weak immune systems are usually the worst affected by toxic black mold.

Toxic Black Mold and Cancer

Experts suspect that toxic black mold can cause cancer, although there still needs to be more research. Some other toxic molds, like Aspergillus for example, definitely cause cancer though. The aflatoxin mycotoxins which Aspergillus produce are among the most powerful carcinogens.

Trichoderma
Trichoderma species are usually considered as non – pathogenic, on the other hand, Trichoderma viride has been reported as a causative agent of pulmonary infection, peritonitis in a dialysis patient, and perihepatic infection in a liver transplant patient. Trichoderma infections are opportunistic in nature and develop in immunocompromised patients, such as neutropenic cases and transplant patients, as well as those with chronic renal failure, chronic lung disease, or amyloidosis. Disseminated infections due to Trichoderma have also been reported.

Trichophyton
Trichophyton is a keratinophilic filamentous fungus which has the ability to invade keratinized tissues; it is considered as one of the leading causes of hair, skin, and nail infections in humans. Possession of several enzymes, such as acid proteinases, elastase, keratinases, and other proteases are the major virulence factors of Trichophyton species.

Out of the total number of species, eleven are commonly associated with tinea of the scalp, the nails, and the skin in humans while only four are often isolated from animals. Additionally, Trichophyton species may cause invasive infections in immunocompromised patients. Trichophyton rubrum is the commonest causative agent of dermatophytoses worldwide.

PARASITES

Acanthamoeba
This is a microscopic, free-living ameba, or amoeba (single-celled living organism), that can cause rare, but severe infections of the eye, skin, and central nervous system. The ameba is found worldwide in the environment in water and soil. The ameba can be spread to the eyes through contact lens use, cuts, or skin wounds or by being inhaled into the lungs. Most people will be exposed to Acanthamoeba during their lifetime, but very few will become sick from this exposure.

Amebiasis
Amebiasis is a disease caused by the parasite Entamoeba histolytica. It can affect anyone, although it is more common in people who live in tropical areas with poor sanitary conditions. Diagnosis can be difficult because other parasites can look very similar to E. histolytica when seen under a microscope. Infected people do not always become sick. If your doctor determines that you are infected and need treatment, medication is available.

Angiostrongyliasis

This is a parasite nematode that can cause severe gastrointestinal or central nervous system disease in humans depending on the species. Angiostrongylus cantonensis, which is also known as the rat lung worm, causes eosinophilic meningitis and is prevalent in Southeast Asia and tropical Pacific islands. The distribution of this parasite has been increasing over time and infections have been identified in Africa, the Caribbean and the United States. Angiostrongylus costaricensis causes eosinophilic gastroenteritis and is found in Latin America and the Caribbean.

Anisakiasis
This is caused by anisakid nematodes (worms) that can invade the stomach wall or intestine of humans. The transmission of this disease occurs when infective larvae are ingested from fish or squid that humans eat raw or undercooked. In some cases, this infection is treated by removal of the larvae via endoscopy or surgery.

Babesiosis
Babesiosis is caused by microscopic parasites that infect red blood cells and are spread by certain ticks. Babesia microti is transmitted by the bite of infected Ixodes scapularis ticks-typically, by the nymph stage of the tick, which is about the size of a poppy seed. Although many people who are infected with Babesia do not have symptoms, effective treatment is available. Babesiosis is preventable, if simple steps are taken to reduce exposure to ticks.

Balantidiasis
Balantidium coli, though rare in the US, is an intestinal protozoan parasite that can infect humans. These parasites can be transmitted through the fecal-oral route by contaminated food and water.Balantidium coli infection is mostly asymptomatic, but people with other serious illnesses can experience persistent diarrhea, abdominal pain, and sometimes a perforated colon. When traveling to endemic tropical countries, Balantidium coli infection can be prevented by following good hygiene practices. Wash all fruits and vegetables with clean water when preparing or eating them, even if they have a removable skin.

Balamuthia
Balamuthia mandrillaris is a free-living ameba (a single-celled living organism) naturally found in the environment. Balamuthia can cause a rare and serious infection of the brain and spinal cord called Granulomatous Amebic Encephalitis (GAE).

Baylisascaris
This is a genus of roundworms. The microscopic larvae hatch in the intestine and invade the intestinal wall. If they are in their definitive host they develop for several weeks, then enter the intestinal lumen, mature, mate, and produce eggs, which are carried out in the fecal stream. If the larvae are in a paratenic host, they break into the bloodstream and enter various organs, particularly the central nervous system. The disease that causes it is Baylisascariasis. A great deal of damage occurs wherever the larva tries to make a home. In response to the attack, the body attempts to destroy it by walling it off or killing it. The larva moves rapidly to escape, seeking out the liver, eyes, spinal cord or brain. Occasionally they can be found in the heart,

lungs, and other organs. Eventually the larva dies and is reabsorbed by the body. In very small species such as mice, it might take only one or two larvae in the brain to be fatal. If the larva does not cause significant damage in vital organs, then the victim will show no signs of disease. On the other hand, if it causes behavioral changes by destroying parts of the brain, the host becomes easier prey, bringing the larva into the intestine of a new host.

Clinical signs in humans:

- Skin irritations from larvae migrating within the skin.
- Respiratory discomfort, liver enlargement, and fever due to reaction to larvae migration.
- Eye and brain tissue damage due to the random migration of the larvae.
- Nausea, a lethargic feeling, incoordination and loss of eyesight.
- Severe neurological signs including imbalance, circling and abnormal behavior, caused by extensive tissue damage due to larval migration through the brain, eventually seizures and coma.

Bed Bugs

Bed bugs, a problem worldwide, are resurging, causing property loss, expense, and inconvenience. The good news is that bed bugs do not transmit disease. The best way to prevent bed bugs is regular inspection for signs of an infestation.

Blastocystis Hominis

This is a common microscopic organism that inhabits the intestine and is found throughout the world. A full understanding of the biology of Blastocystis and its relationship to other organisms is not clear, but is an active area of research.

Capillariasis

Capillariasis is a parasitic disease in humans caused by two different species of capillarids: Capillaria hepatica and Capillaria philippinensis.C. hepatica is transferred through the fecal matter of infected animals and can lead to hepatitis. C. philippinensis is transferred through ingesting infected small freshwater fish and can lead to diarrhea and emaciation.

Cercarial Dermatitis

Swimmer’s itch, also called cercarial dermatitis, appears as a skin rash caused by an allergic reaction to certain parasites that infect some birds and mammals. These microscopic parasites are released from infected snails into fresh and saltwater (such as lakes, ponds, and oceans). While the parasite’s preferred host is the specific bird or mammal, if the parasite comes into contact with a swimmer, it burrows into the skin causing an allergic reaction and rash. Swimmer’s itch is found throughout the world and is more frequent during summer months. Most cases of swimmer’s itch do not require medical attention.

Chagas Disease (AmericanTrypanosomiasis)

This is caused by the parasite Trypanosoma cruzi, which is transmitted to animals and people by insect vectors and is found only in the Americas (mainly, in rural areas of Latin America where poverty is widespread).

Chilomastix Mesnili
This is a non-parasitic member of primate gastrointestinal microflora, commonly associated with but not causing parasitic infections. It is found in about 3.5% of the population in the United States. In addition to humans, Chilomastix is found in chimpanzees, orangutans, monkeys, and pigs. It lives in the cecum and colon. C. mesnili has a similar lifestyle to Giardia lamblia.

Although Chilomastix mesnili is considered non-pathogenic, it often occurs with other parasite infections. C. mesnili may be confused with other pathogenic species during diagnosis. It can create a false positive which would result in unnecessary treatment or a false negative which would withhold necessary treatment.

Clonorchiasis
This is a liver fluke that can infect the liver, gallbladder and bile duct in humans. Found across parts of Asia, it is also known as the Chinese or oriental liver fluke. Humans become infected when eating the parasite containing cysts within infected raw or undercooked fish, crabs, or crayfish. Clonorchiasis can be treated by medication through your health professional.

CLM (Cutaneous Larva Migrans, Ancylostomiasis, Hookworm)
Zoonotic hookworms are hookworms that live in animals but can be transmitted to humans. Dogs and cats can become infected with several hookworm species, including Ancylostoma braziliense, A. caninum, A. ceylanicum, and Uncinaria stenocephala. The eggs of these parasites are shed in the feces of infected animals and can end up in the environment, contaminating the ground where the animal defecated. People become infected when the zoonotic hookworm larvae penetrate unprotected skin, especially when walking barefoot or sitting on contaminated soil or sand. This can result in a disease called cutaneous larva migrans (CLM), when the larvae migrate through the skin and cause inflammation.

Crabs
Pithariasis Adult pubic lice are 1.1-1.8 mm in length. Pubic lice typically are found attached to hair in the pubic area but sometimes are found on coarse hair elsewhere on the body (for example, eyebrows, eyelashes, beard, mustache, chest, armpits, etc.). Pubic lice infestations (pthiriasis) are usually spread through sexual contact. Dogs, cats, and other pets do not play a role in the transmission of human lice.

Cryptosporidiosis
Cryptosporidium is a microscopic parasite that causes the diarrheal disease cryptosporidiosis. Both the parasite and the disease are commonly known as “Crypto.”

There are many species of Cryptosporidium that infect animals, some of which also infect humans. The parasite is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it very tolerant to chlorine disinfection.

While this parasite can be spread in several different ways, water (drinking water and recreational water) is the most common way to spread the parasite. Cryptosporidium is a leading cause of waterborne disease among humans in the United States.

Cyclosporiasis
Cyclosporiasis is an intestinal illness caused by the microscopic parasite Cyclospora cayetanensis. People can become infected withCyclospora by consuming food or water contaminated with the parasite. People living or traveling in countries where cyclosporiasis is endemic may be at increased risk for infection.

Cysticercosis
Cysticercosis is a parasitic tissue infection caused by larval cysts of the tapeworm Taenia solium. These larval cysts infect brain, muscle, or other tissue, and are a major cause of adult onset seizures in most low-income countries. A person gets cysticercosis by swallowing eggs found in the feces of a person who has an intestinal tapeworm. People living in the same household with someone who has a tapeworm have a much higher risk of getting cysticercosis than people who don't. People do not get cysticercosis by eating undercooked pork. Eating undercooked pork can result in intestinal tapeworm if the pork contains larval cysts. Pigs become infected by eating tapeworm eggs in the feces of a human infected with a tapeworm. Both the tapeworm infection, also known as taeniasis, and cysticercosis occur globally. The highest rates of infection are found in areas of Latin America, Asia, and Africa that have poor sanitation and free-ranging pigs that have access to human feces.

Cystoisospora (formerly known as isosporiasis)
This is an intestinal disease of humans caused by the coccidian parasite Cystoisospora belli (formerly known asIsospora belli). Cystoisosporiasis is most common in tropical and subtropical areas of the world. The parasite can be spread by ingesting contaminated food or water. The most common symptom is watery diarrhea. The infection is treatable and preventable.

Dientamoeba Fragilis
This is a parasite that lives in the large intestine of people. This protozoan parasite produces trophozoites; cysts have not been identified. The intestinal infection may be either asymptomatic or symptomatic.

Diphyllobothriasis
Diphyllobothrium latum and related species (the fish or broad tapeworm), the largest tapeworms that can infect people, can grow up to 30 feet long. While most infections are asymptomatic, complications include intestinal obstruction and gallbladder disease caused by migration of proglottids. Diagnosis is made by identification of eggs or segments of the tapeworm in a stool

sample with a microscope. Safe and effective medications are available to treat Diphyllobothrium. Infections are acquired by eating raw or undercooked fish, usually from the Northern Hemisphere (Europe, newly independent states of the Former Soviet Union, North America, Asia), but cases have also been reported in Uganda and Chile.

Dipylidium
This is a tapeworm of cats and dogs. People become infected when they accidentally swallow a flea infected with tapeworm larvae; most reported cases involve children. Dipylidium infection is easily treated in humans and animals.

Dirofilariasis
Dirofilariasis in humans is caused by Dirofilaria roundworms. The main natural hosts for the three Dirofilaria species that most frequently cause disease in humans are dogs and wild canids (such as wolves and foxes) and raccoons. Humans are infected with Dirofilaria larvae through mosquito bites. Infection can result in nodules under the skin or conjunctiva and lung granulomas (small nodules formed by an inflammatory reaction) that appear as coin lesions (small, round abnormalities) on x-rays, leading to diagnostic procedures to exclude more serious diseases.

Dracunculiasis (Guinea Worm Disease)
This is considered a neglected tropical disease, and is caused by the parasite Dracunculus medinensis. The disease affects poor communities in remote parts of Africa that do not have safe water to drink. There is no drug treatment for Guinea worm disease nor a vaccine to prevent it.

Echinococcosis (Hytadid)
This is a parasitic disease caused by infection with tiny tapeworms of the genus Echinococcus. There are two types Cystic echinococcosis (CE), is caused by infection with the larval stage of Echinococcus granulosus, a ~2-7 millimeter long tapeworm found in dogs (definitive host) and sheep, cattle, goats, and pigs (intermediate hosts). Although most infections in humans are asymptomatic, CE causes harmful, slowly enlarging cysts in the liver, lungs, and other organs that often grow unnoticed and neglected for years. Alveolar echinococcosis (AE) disease is caused by infection with the larval stage of Echinococcus multilocularis, a ~1-4 millimeter long tapeworm found in foxes, coyotes, and dogs (definitive hosts). Small rodents are intermediate hosts for E. multilocularis. Although cases of AE in animals in endemic areas are relatively common, human cases are rare. AE poses a much greater health threat to people than CE, causing parasitic tumors that can form in the liver, lungs, brain, and other organs. If left untreated, AE can be fatal.

Elephantiasis
This is a symptom of a variety of diseases, where parts of a person's body swell to massive proportions.

Some conditions that have this symptom include:

- Elephantiasis nostras, due to long standing chronic lymphangitis
- Elephantiasis tropica or lymphatic filariasis, caused by a number of parasitic worms, particularly Wuchereria bancrofti. More than 120 million people, mostly in Africa and Southeast Asia, are affected.
- Non Filarial elephantiasis or podoconiosis, an immune disease affecting the lymph vessels
- Elephantiasis, Grade 3 lymphedema which may occur in people with breast cancer.
- Genital elephantiasis, end result of lymphogranuloma venereum
- Proteus syndrome, the genetic disorder of the so-called Elephant Man.

Endolimax Nana

This is the smallest of the intestine-dwelling amoebae infecting humans, its trophozoite averaging only 8 μm in diameter (range, 6-15 μm). The trophozoite lives in the host's colon and is generally considered to be nonpathogenic. According to some surveys, prevalence may be as high as 30% in some populations. The life cycle is identical to that of other cyst-forming amoebae, with the cyst being the infective stage. E. nana cysts can be identified and distinguished from other cysts by their smaller size (9 μm in greatest diameter; range, 5-14 μm, ovoid shape, and one to four vesicular nuclei, each usually containing a large, eccentric endosome).

Entamoeba Coli

This is a non-pathogenic species of Entamoeba that frequently exists as a commensal parasite in the human gastrointestinal tract. E. coli (not to be confused with the bacterium Escherichia coli) is important in medicine because it can be confused during microscopic examination of stained stool specimens with the pathogenic Entamoeba histolytica. This amoeba does not move much by the use of its pseudopod, and creates a "sur place (non-progressive) movement" inside the large intestine. Usually, the amoeba is immobile, and keeps its round shape. This amoeba, in its trophozoite stage, is only visible in fresh, unfixed stool specimens. Sometimes the Entamoeba coli have parasites as well. One is the fungus Sphaeritaspp. This fungus lives in the cytoplasm of the E. coli. While this differentiation is typically done by visual examination of the parasitic cysts via light microscopy, new methods using molecular biology techniques have been developed. The scientific name of the amoeba, E. coli, is often mistaken for the bacterium, Escherichia coli. Unlike the bacterium, the amoeba is mostly harmless, and does not cause as many intestinal problems as some strains of the E. coli bacterium. Some of these harmful strains are inside raw or uncooked meat that is consumed. For example, the bacterium, E. coli O157:H7, which can cause illness, and even death, if eaten. To make the naming of these organisms less confusing, "alternate contractions" are used to name the species for the purpose of making the naming easier; for example, using Esch. coli and Ent. coli for the bacterium and amoeba, instead of using E. coli for both.

Entamoeba Dispar

Entamoeba Hartmanni

Entamoeba Histolytica
Amebiasis is a disease caused by the parasite Entamoeba histolytica. It can affect anyone, although it is more common in people who live in tropical areas with poor sanitary conditions. Diagnosis can be difficult because other parasites can look very similar to E. histolytica when seen under a microscope. Infected people do not always become sick. If your doctor determines that you are infected and need treatment, medication is available.

Entamoeba Polecki
Entamoeba polecki is a single-celled parasite that is found in intestines, mainly in pigs and monkeys. Other animals that it can be found in are cattle, goats, sheep, dogs, and humans. The way humans get infected is by swallowing the parasite.

Fascioliasis
Fascioliasis is a parasitic infection typically caused by Fasciola hepatica, which is also known as “the common liver fluke” or “the sheep liver fluke.” A related parasite, Fasciola gigantica, also can infect people. Fascioliasis is found in all 5 continents, in over 50 countries, especially where sheep or cattle are reared. People usually become infected by eating raw watercress or other water plants contaminated with immature parasite larvae. The immature larval flukes migrate through the intestinal wall, the abdominal cavity, and the liver tissue, into the bile ducts, where they develop into mature adult flukes, which produce eggs. The pathology typically is most pronounced in the bile ducts and liver. Fasciola infection is both treatable and preventable.

Fasciolopsiasis
The intestinal fluke Fasciolopsis buski, which causes fasciolopsiasis, is the largest intestinal fluke of humans. Fasciolopsiasis can be prevented by cooking aquatic plants well before eating them. Fasciolopsis is found in south and southeastern Asia. Fasciolopsiasis is treatable.

Giardiasis
Giardia is a microscopic parasite that causes the diarrheal illness known as giardiasis. Giardia (also known as Giardia intestinalis, Giardia lamblia, or Giardia duodenalis) is found on surfaces or in soil, food, or water that has been contaminated with feces (poop) from infected humans or animals.

Giardia is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it tolerant to chlorine disinfection. While the parasite can be spread in different ways, water (drinking water and recreational water) is the most common mode of transmission.

Gnathostomiasis
Human gnathostomiasis is caused by several species of parasitic worms (nematodes) in the genus Gnathostoma. The disease is found and is most commonly diagnosed in Southeast Asia, though it has also been found elsewhere in Asia, in South and Central America, and in some areas of Africa. People become infected primarily by eating undercooked or raw freshwater fish, eels, frogs, birds, and reptiles. The most common manifestations of the infection in humans are

migratory swellings under the skin and increased levels of eosinophils in the blood. Rarely, the parasite can enter other tissues such as the liver, and the eye, resulting in vision loss or blindness, and the nerves, spinal cord, or brain, resulting in nerve pain, paralysis, coma and death.

Heterophyiasis
The definitive host becomes infected by ingesting undercooked or salted fish containing metacercariae. After ingestion, the metacercariae excyst, attach to the mucosa of the small intestine and mature into adults. The main symptoms are diarrhea and colicky abdominal pain. Migration of the eggs to the heart, resulting in potentially fatal myocardial and valvular damage, has been reported from the Philippines. Migration to other organs (e.g., brain) has also been reported.

Hookworm Human
Hookworm, Ascaris, and whipworm are known as soil transmitted helminths (parasitic worms). Together, they account for a major burden of disease worldwide. Hookworms live in the small intestine. Hookworm eggs are passed in the feces of an infected person. If the infected person defecates outside (near bushes, in a garden, or field) of if the feces of an infected person are used as fertilizer, eggs are deposited on soil. They can then mature and hatch, releasing larvae (immature worms). The larvae mature into a form that can penetrate the skin of humans. Hookworm infection is mainly acquired by walking barefoot on contaminated soil. One kind of hookworm can also be transmitted through the ingestion of larvae.

Most people infected with hookworms have no symptoms. Some have gastrointestinal symptoms, especially persons who are infected for the first time. The most serious effects of hookworm infection are blood loss leading to anemia, in addition to protein loss. Hookworm infections are treatable with medication prescribed by your healthcare provider.

Hookworm Zoonotic
Zoonotic hookworms are hookworms that live in animals but can be transmitted to humans. Dogs and cats can become infected with several hookworm species, including Ancylostoma braziliense, A. caninum, A. ceylanicum, and Uncinaria stenocephala. The eggs of these parasites are shed in the feces of infected animals and can end up in the environment, contaminating the ground where the animal defecated. People become infected when the zoonotic hookworm larvae penetrate unprotected skin, especially when walking barefoot or sitting on contaminated soil or sand. This can result in a disease called cutaneous larva migrans (CLM), when the larvae migrate through the skin and cause inflammation.

Hymenolepiasis
This infection with the dwarf tapeworm is found worldwide. It is most often seen in children in countries in which sanitation and hygiene are inadequate. Although the dwarf tapeworm infection rarely causes symptoms, it can be misdiagnosed for pinworm infection.

Kala-azar

Leishmaniasis is a parasitic disease that is found in parts of the tropics, subtropics, and southern Europe. It is classified as a neglected tropical disease. Leishmaniasis is caused by infection with Leishmania parasites, which are spread by the bite of phlebotomine sand flies. There are several different forms of leishmaniasis in people. The most common forms are cutaneous leishmaniasis, which causes skin sores, and visceral leishmaniasis, which affects several internal organs (usually spleen, liver, and bone marrow).

Keratitis
This is a condition in which the eye‘s cornea, the clear dome on the front surface of the eye, becomes inflamed. The condition is often marked by moderate to intense pain and usually involves any of the following symptoms: pain, impaired eyesight, photophobia (light sensitivity), red eye and a ‘gritty’ sensation.

Loiasis
Loiasis, called African eye worm by most people, is caused by the parasitic worm Loa loa. It is passed on to humans through the repeated bites of deer flies (also known as mango flies or mangrove flies) of the genus Chrysops. The flies that pass on the parasite breed in certain rain forests of West and Central Africa. Infection with the parasite can also cause repeated episodes of itchy swellings of the body known as Calabar swellings. Knowing whether someone has a Loa loa infection has become more important in Africa because the presence of people with Loa loa infection has limited programs to control or eliminate (river blindness) and (elephantiasis). There may be more than 29 million people who are at risk of getting loiasis in affected areas of Central and West Africa.

Lymph Filariasis
Lymphatic filariasis, considered globally as a neglected tropical disease, is a parasitic disease caused by microscopic, thread-like worms. The adult worms only live in the human lymph system. The lymph system maintains the body’s fluid balance and fights infections. Lymphatic filariasis is spread from person to person by mosquitoes. People with the disease can suffer from lymphedema and elephantiasis and in men, swelling of the scrotum, called hydrocele. Lymphatic filariasis is a leading cause of permanent disability worldwide. Communities frequently shun and reject women and men disfigured by the disease. Affected people frequently are unable to work because of their disability, and this harms their families and their communities.

Malaria
This is a mosquito-borne disease caused by a parasite. People with malaria often experience fever, chills, and flu-like illness. Left untreated, they may develop severe complications and die.

Microsporidiosis
The microsporidia are a group of obligate intracellular parasitic fungi. Historically, they have been treated among the protozoa, and as such are often still managed by diagnostic parasitology laboratories. To date, more than 1,200 species belonging to 143 genera have been described as parasites infecting a wide range of vertebrate and invertebrate hosts.

Microsporidia are characterized by the production of resistant spores that vary in size, depending on the species. They possess a unique organelle, the polar tubule or polar filament, which is coiled inside the spore as demonstrated by its ultrastructure. The microsporidia spores of species associated with human infection measure from 1 to 4 μm and that is a useful diagnostic feature. There are at least 15 microsporidian species that have been identified as human pathogens: Anncaliia (formerly Brachiola) algerae, A. connori, A. vesicularum, Encephalitozoon cuniculi, E. hellem, E. intestinalis, Enterocytozoon bieneusi Microsporidium ceylonensis, M. africanum, Nosema ocularum, Pleistophora sp.,Trachipleistophora hominis, T. anthropophthera, Vittaforma corneae, and Tubulinosema acridophagus. Encephalitozoon intestinalis

Myiasis

Myiasis is the infection of a fly larva (maggot) in human tissue. This occurs in tropical and subtropical areas. Myiasis is rarely acquired in the United States; people typically get the infection when they travel to tropical areas in Africa and South America. People traveling with untreated and open wounds are more at risk for getting myiasis. Fly larvae need to be surgically removed by a medical professional.

Naegleria

Naegleria fowleri (commonly referred to as the “brain-eating amoeba” or “brain-eating ameba”), is a free-living microscopic ameba, (single-celled living organism). It can cause a rare and devastating infection of the brain called primary amebic meningoencephalitis (PAM). The ameba is commonly found in warm freshwater (e.g. lakes, rivers, and hot springs) and soil. Naegleria fowleri usually infects people when contaminated water enters the body through the nose. Once the ameba enters the nose, it travels to the brain where it causes PAM, which is usually fatal. Infection typically occurs when people go swimming or diving in warm freshwater places, like lakes and rivers. In very rare instances, Naegleria infections may also occur when contaminated water from other sources (such as inadequately chlorinated swimming pool water or heated and contaminated tap water) enters the nose. You cannot get infected from swallowing water contaminated with Naegleria.

Neurocysticercosis

Cysticercosis is a parasitic infection that results from ingestion of eggs from the adult tapeworm, Taenia solium (T. solium) (1,2). When cysticercosis involves the central nervous system, it is called neurocysticercosis. Neurocysticercosis is the most common parasitic infection of the brain and a leading cause of epilepsy in the developing world, especially Latin America, India, Africa, and China (1–12).

Opisthorchiasis

Opisthorchis species are liver fluke parasites acquired by eating raw or undercooked fish from endemic countries: Thailand, Laos, Cambodia, Viet Nam, and other areas of Asia, Eastern Europe, and the former Soviet Union. While most infected persons are asymptomatic, infections of longer duration can result in severe symptoms and serious illness. Diagnosis is based on

identification of eggs in stool specimens with a microscope. Safe and effective medication is available to treat Opisthorchis infections. Adequately freezing or cooking fish will kill the parasite.

Paragonimiasis
Paragonimus is a lung fluke (flatworm) that infects the lungs of humans after eating an infected raw or undercooked crab or crayfish. Less frequent, but more serious cases of paragonimiasis occur when the parasite travels to the central nervous system. Although rare, paragonimiasis has been acquired in the United States, with multiple cases reported from the Midwest. Once the diagnosis is made, effective treatment for paragonimiasis is available from a physician.

Pediculosis Lice
Lice are parasitic insects that can be found on people's heads, and bodies, including the pubic area. Human lice survive by feeding on human blood. Lice found on each area of the body are different from each other. Pediculus humanus capitis (head louse) and Pediculus humanus corporis(body louse, clothes louse). Only the body louse is known to spread disease. Lice infestations are spread most commonly by close person-to-person contact. Dogs, cats, and other pets do not play a role in the transmission of human lice. Lice move by crawling; they cannot hop or fly. Both over-the-counter and prescription medications are available for treatment of lice infestations.

Pneumocystis
Pneumocystis jirovecii (previously classified as Pneumocystis carinii) was previously classified as a protozoa. Currently, it is considered a fungus based on nucleic acid and biochemical analysis.

River Blindness (Onchocerciasis)
This is a neglected tropical disease caused by the parasitic worm Onchocerca volvulus. It is transmitted through repeated bites by blackflies of the genus Simulium. The disease is called River Blindness because the blackfly that transmits the infection lives and breeds near fast-flowing streams and rivers and the infection can result in blindness. In addition to visual impairment or blindness, onchocerciasis causes skin disease, including nodules under the skin or debilitating itching. Worldwide onchocerciasis is second only to trachoma as an infectious cause of blindness.

Roundworm Human (ascariasis)
Ascaris lives in the intestine and Ascaris eggs are passed in the feces of infected persons. If the infected person defecates outside (near bushes, in a garden, or field) or if the feces of an infected person is used as fertilizer, eggs are deposited on soil. They can then mature into a form that is infectious. Ascariasis is caused by ingesting eggs. This can happen when hands or fingers that have contaminated dirt on them are put in the mouth or by consuming vegetables or fruits that have not been carefully cooked, washed or peeled. People infected with Ascaris often

show no symptoms. If symptoms do occur they can be light and include abdominal discomfort. Heavy infections can cause intestinal blockage and impair growth in children. Other symptoms such as cough are due to migration of the worms through the body. Ascariasis is treatable with medication prescribed by your healthcare provider.

Roundworm Raccoon
Baylisascaris infection is caused by a roundworm found in raccoons. This roundworm can infect people as well as a variety of other animals, including dogs. Human infections are rare, but can be severe if the parasites invade the eye (ocular larva migrans), organs (visceral larva migrans) or the brain (neural larva migrans).

Sappinia
This is a free-living ameba, or amoeba (a single-celled living organism), found in the environment. There are two known species of Sappinia: Sappinia diploidea and Sappinia pedata. This ameba causes amebic encephalitis, which is an infection of the brain. Worldwide, only one case of amebic encephalitis due to Sappinia infection has been reported.

Sarcocystosis
Sarcocystosis is a disease caused by a microscopic parasite Sarcocystis. In humans, two types of the disease can occur, one causes diarrhea, mild fever, and vomiting (intestinal type), and the other type causes muscle pain, transitory edema, and fever (muscular type). However, most people infected with Sarcocystis do not have symptoms. Sarcocystosis occurs in tropical or subtropical countries. Muscular sarcocystosis has most often been reported from countries in Southeast Asia.

Scabies
Human scabies is caused by an infestation of the skin by the human itch mite (Sarcoptes scabiei var. hominis). The microscopic scabies mite burrows into the upper layer of the skin where it lives and lays its eggs. The most common symptoms of scabies are intense itching and a pimple-like skin rash. The scabies mite usually is spread by direct, prolonged, skin-to-skin contact with a person who has scabies.

Scabies occurs worldwide and affects people of all races and social classes. Scabies can spread rapidly under crowded conditions where close body contact is frequent. Institutions such as nursing homes, extended-care facilities, and prisons are often sites of scabies outbreaks.

Schistosomiasis
Schistosomiasis, also known as bilharzia, is a disease caused by parasitic worms. Although the worms that cause schistosomiasis are not found in the United States, more than 200 million people are infected worldwide. In terms of impact this disease is second only to malaria as the most devastating parasitic disease. The parasites that cause schistosomiasis live in certain types of freshwater snails. The infectious form of the parasite, known as cercariae, emerges from the snail, hence contaminating water. You can become infected when your skin comes in

contact with contaminated freshwater. Most human infections are caused by Schistosoma mansoni, S. haematobium, or S. japonicum.

Strongyloidiasis
It is a parasitic disease caused by nematodes, or roundworms, in the genus Strongyloides that enter the body through exposed skin, such as bare feet. Strongyloides is most common in tropical or subtropical climates.Most people who are infected with Strongyloides do not know they are infected and have no symptoms. Others may develop a severe form and, if untreated, become critically ill and potentially die.

Tapeworm (Human)
Taeniasis in humans is a parasitic infection caused by the tapeworm species Taenia saginata (beef tapeworm), Taenia solium (pork tapeworm), and Taenia asiatica (Asian tapeworm). Humans can become infected with these tapeworms by eating raw or undercooked beef (T. saginata) or pork (T. soliumand T. asiatica). People with taeniasis may not know they have a tapeworm infection because symptoms are usually mild or nonexistent. Taenia solium tapeworm infections can lead to cysticercosis, which is a disease that can cause seizures, so it is important to seek treatment.

Toxocariasis (Roundworm)
This can also cause Ocular Larva Migrans: Toxocariasis is the parasitic disease caused by the larvae of two species of Toxocara Roundworms: Toxocara canis from dogs and, less commonly, Toxocara cati from cats. Toxocariasis is considered one of the neglected parasitic infections https://www.cdc.gov/parasites/npi, a group of five parasitic diseases that have been targeted by CDC for public health action.

Toxoplasmosis
Toxoplasmosis is considered to be a leading cause of death attributed to foodborne illness in the United States. More than 60 million men, women, and children in the U.S. carry the Toxoplasma parasite, but very few have symptoms because the immune system usually keeps the parasite from causing illness. However, women newly infected with Toxoplasma during pregnancy and anyone with a compromised immune system should be aware that toxoplasmosis can have severe consequences.

Trichinellosis
Trichinellosis, also called trichinosis, is a disease that people can get by eating raw or undercooked meat from animals infected with the microscopic parasite Trichinella.

Trichomoniasis
This is a sexually transmitted disease (STD). Both men and women can get trichomoniasis. Many people who have trichomoniasis don’t know it. The infection often has no symptoms. Women are more likely than men to get symptoms. You can pass trichomoniasis to others without knowing it. Trichomoniasis is easy to treat and cure. Women should be tested for

trichomoniasis if you have any of these symptoms: A discharge from your vagina, pain when you have sex, pain when you pass urine.

Trichuriasis
An estimated 604-795 million people in the world are infected with whipworms. Whipworm, hookworm, and Ascaris are known as soil transmitted helminths (parasitic worms). Together, they account for a major burden of disease worldwide. Whipworms live in the large intestine and whipworm eggs are passed in the feces of infected persons. If the infected person defecates outside (near bushes, in a garden, or field) or if human feces is used as fertilizer, eggs are deposited on soil. They can then mature into a form that is infectious. Whipworm infection is caused by ingesting eggs. This can happen when hands or fingers that have contaminated dirt on them are put in the mouth.

Trypanosomiasis
This is the name of several diseases in vertebrates caused by parasitic protozoan trypanosomes of the genus Trypanosoma. In humans this includes African trypanosomiasis and Chagas disease.

The tsetse fly bite erupts into a red chancre sore and within a few weeks, the person can experience fever, swollen lymph glands, blood in urine, aching muscles and joints, headaches and irritability. In the first phase, the patient has only intermittent bouts of fever with lymphadenopathy together with other non-specific signs and symptoms. The second stage of the disease is marked by involvement of the central nervous system with extensive neurological effects like changes in personality, alteration of the biological clock (the circadian rhythm), confusion, slurred speech, seizures and difficulty in walking and talking. These problems can develop over many years and if not treated, the person dies. It is common to the African continent.

VIRUSES

Bornavirus (BDV)
Borna disease virus, a newly classified nonsegmented negative-strand RNA virus with international distribution, infects a broad range of warm-blooded animals from birds to primates. Infection causes movement and behavioral disturbances reminiscent of some neuropsychiatric syndromes. The virus has not been clearly linked to any human disease; however, an association between infection with the virus and selected neuropsychiatric disorders has been suggested.

Coxsackie Virus
There are two different types of coxsackieviruses: A and B. Type A viruses cause herpangina (sores in the throat) and hand, foot, and mouth disease. Type B viruses cause epidemic

pleurodynia, and inflammation in the chest. Both types A and B viruses can cause meningitis (inflammation of the spinal cord or brain), myocarditis (inflammation of the heart muscle), and pericarditis (inflammation of the sac surrounding the heart). They also may have a role in the development of acute onset juvenile (type 1) diabetes.

Cytomegalovirus (CMV)
This is a double-stranded DNA virus and is a member of the Herpesviridae family. Cytomegalovirus (CMV) is a common virus. Most people are exposed to the virus as infants. It is believed that most adults are diagnosed with the virus by age 40. Many people are infected with CMV and don't know it. That's because the virus rarely causes symptoms. It usually does not cause long-term problems. However, CMV can cause problems in people who have a weakened immune system. Also, it can cause problems in a newborn if the mother gets the infection during pregnancy.

Signs and Symptoms:

- CMV usually causes an asymptomatic infection or produces mild flu-like symptoms;
    - afterward, it remains latent throughout life and may reactivate. Most patients with CMV infection exhibit few clinical findings on physical examination. Primary CMV infection may be a cause of fever of unknown origin. Symptoms, when apparent, develop 9-60 days after primary infection.
- Pharyngitis may be present.
- Examination of the lungs may reveal fine crackles.
- The lymph nodes and spleen may be enlarged, so CMV should be included in the differential diagnosis of infections that produce lymphadenopathy.

In immunocompromised individuals, symptomatic disease usually manifests as mononucleosis syndrome. Symptomatic CMV disease can affect almost every organ of the body, resulting in fever of unknown origin, pneumonia, hepatitis, encephalitis, myelitis, colitis, uveitis, retinitis, and neuropathy. Rarer manifestations of CMV infections in immunocompetent individuals include Guillain-Barré syndrome, meningoencephalitis, pericarditis, myocarditis, thrombocytopenia, and hemolytic anemia.

In patients with HIV infection, CMV involves the entire GI tract. Retinitis is the most common manifestation of CMV disease in patients who are HIV positive.

Epstein Barr Virus (EBV)
Belongs to the family of herpes viruses including those that cause cold sores, genital herpes, chickenpox and shingles. Infection with EBV is virtually inescapable; in the US, 95% of all adults will be infected by age 40, and 50% of all children by age 5. Many people don't realize they have been infected because they never feel sick. Once infected however, you harbor the virus for good.

Herpes Simplex 1(HSV-1)
HSV-1 is the main cause of herpes infections on the mouth and lips, including cold sores and fever blisters. It is transmitted through kissing or sharing drinking glasses and utensils. HSV-1 can also cause genital herpes, although HSV-2 is the main cause of genital herpes. Exposure to HSV-1 is extremely common, as many as 90% of American adults have been exposed to the virus, and there is no stigma to having a cold sore.

Symptoms may include:

- Small, painful, fluid-filled blisters around the lips or edge of the mouth
- Tingling or burning around the mouth or nose, often a few days before blisters appear
- Fever
- Sore throat
- Swollen lymph nodes in neck

Herpes Simplex 2 (HSV-2)
A herpes virus that causes genital herpes, characterized by sores in the genital area. It is a sexually transmitted disease. HSV-2 can also cause infection of the brain (encephalitis) if the immune system is severely defective or compromised. The treatment of infection with herpes simplex 2 is usually by topical or oral antiviral medication, although intravenous therapy is required to treat infections of the brain (encephalitis).

Symptoms may include:

- Tingling sensation in the genitalia, buttocks, and thighs
- Small red blisters or open sores on genitals or inner thighs; in women, often occur inside the vagina
- May be painful or not
- In women, vaginal discharge
- Fever, muscle aches
- Headache
- Painful urination
- Swollen lymph glands in the groin

Hepatitis A
Hepatitis A (formerly known as infectious hepatitis) is an infectious disease of the liver caused by the hepatitis A virus (HAV). Many cases have few or no symptoms, especially in the young. The time between infection and symptoms, in those who develop them, is between two and six weeks. When symptoms occur, they typically last eight weeks and may include nausea, vomiting, diarrhea, jaundice, fever, and abdominal pain. Around 10-15% of people experience a recurrence of symptoms during the six months after the initial infection. Acute liver failure may rarely occur, with this being more common in the elderly. It is usually spread by eating food or drinking water contaminated with infected feces. Shellfish which have not been sufficiently cooked are a relatively common source. It may also be spread through close contact with an

infectious person. While children often do not have symptoms when infected, they are still able to infect others. After a single infection, a person is immune for the rest of his or her life.

Hepatitis B

Hepatitis B is an infectious disease caused by the hepatitis B virus (HBV) that affects the liver. It can cause both acute and chronic infections. Many people have no symptoms during the initial infection. Some develop a rapid onset of sickness with vomiting, yellowish skin, tiredness, dark urine and abdominal pain. Often these symptoms last a few weeks and rarely does the initial infection result in death. It may take 30 to 180 days for symptoms to begin. In those who get infected around the time of birth 90% develop chronic hepatitis B while less than 10% of those infected after the age of five do. Most of those with chronic disease have no symptoms; however, cirrhosis and liver cancer may eventually develop. These complications result in the death of 15 to 25% of those with chronic disease.

Hepatitis C

The virus is transmitted by exposure to infectious blood or body fluids. Infection around the time of birth or from contact with other people's blood during childhood is the most frequent method by which hepatitis B is acquired in areas where the disease is common. In areas where the disease is rare, intravenous drug use and sexual intercourse are the most frequent routes of infection. Other risk factors include working in healthcare, blood transfusions, dialysis, living with an infected person, travel in countries where the infection rate is high, and living in an institution. The hepatitis B viruses cannot be spread by holding hands, sharing eating utensils, kissing, hugging, coughing, sneezing, or breastfeeding.

Hepatitis C is an infectious disease caused by the hepatitis C virus (HCV) that primarily affects the liver. During the initial infection people often have mild or no symptoms. Occasionally a fever, dark urine, abdominal pain, and yellow tinged skin occurs. The virus persists in the liver in about 75% to 85% of those initially infected. Early on chronic infection typically has no symptoms. Over many years however, it often leads to liver disease and occasionally cirrhosis. In some cases, those with cirrhosis will develop complications such as liver failure, liver cancer, or esophageal and gastric varices.

HCV is spread primarily by blood-to-blood contact associated with intravenous drug use, poorly sterilized medical equipment, needlestick injuries in healthcare, and transfusions. Using blood screening, the risk from a transfusion is less than one per two million. It may also be spread from an infected mother to her baby during birth. It is not spread by superficial contact. There is no vaccine against hepatitis C.

Hepatitis D

Hepatitis D (hepatitis delta) is a disease caused by the hepatitis D virus (HDV), a small spherical enveloped viroid. HDV is considered to be a subviral satellite because it can propagate only in the presence of the hepatitis B virus (HBV). Transmission of HDV can occur either via simultaneous infection with HBV (coinfection) or superimposed on chronic hepatitis B or hepatitis B carrier state (superinfection).

Both superinfection and coinfection with HDV results in more severe complications compared to infection with HBV alone. These complications include a greater likelihood of experiencing liver failure in acute infections and a rapid progression to liver cirrhosis, with an increased risk of developing liver cancer in chronic infections. In combination with hepatitis B virus, hepatitis D has the highest fatality rate of all the hepatitis infections, at 20%.

Hepatitis E

Hepatitis E is a viral hepatitis (liver inflammation) caused by infection with a virus called hepatitis E virus.[1] It is one of five known human hepatitis viruses: A, B, C, D, and E. HEV is a positive-sense single-stranded non-enveloped RNA icosahedral virus, HEV has a fecal-oral transmission route.

Although Hepatitis E often causes an acute and self-limiting infection (the virus usually resolves itself and the individual recovers) with low mortality rates in the western world, it bears a high risk of developing chronic hepatitis in immunocompromised patients with substantial mortality rates. Organ transplant recipients who receive immunosuppressive medication to prevent rejection are thought to be the main population at risk for chronic hepatitis E. Furthermore, in healthy individuals during the duration of the infection, the disease severely impairs a person's ability to work, care for family members, and other daily activities. Hepatitis E occasionally develops into an acute, severe liver disease, and is fatal in about 2% of all cases. Clinically, it is comparable to hepatitis A, but in pregnant women the disease is more often severe and is associated with a clinical syndrome called fulminant liver failure. Pregnant women, especially those in the third trimester, suffer an elevated mortality rate from the disease of around 20%.

Human Herpesvirus-6 (HHV-6)

This is the virus that most commonly causes the childhood disease, roseola. It was first discovered in 1986. Studies show that HHV-6 infects approximately 90% of children by age 2 years. It is usually marked by several days of high fever followed by a distinctive rash just as the fever breaks. In less than 1 percent of all adults, the virus can also slyly work its own DNA into the human genome. This makes it possible for mothers and fathers to pass HHV-6 to their children if these insertions are present in their eggs or sperm.

Human herpesvirus 6A (HHV-6A), A is rare, and acquired in adulthood, and human herpesvirus 6B (HHV-6B), B is common, usually acquired in childhood. Both A and B can reactivate at a later date, and are believed to contribute to diseases of the bone marrow and/or central nervous system in some people. HHV-6B has been associated with a variety of viral illnesses, including exanthem subitum, roseola infantum, fatal encephalitis, focal encephalitis, mononucleosis, lymphadenopathy, myocarditis, myelosuppression, and pneumonitis.

Many cases of HHV-6 infections are silent or appear with a fever, but HHV-6 infection in infants is the most common cause of fever-induced seizures usually associated with the primary HHV-6 infection. HHV-6 infection in adults is seen usually in those having a compromised immune system, those who have undergone organ transplants or in those with HIV infection.

New research suggests that HHV-6 may play a role in several chronic neurological conditions including MS (multiple sclerosis), mesial temporal lobe epilepsy, status epilepticus, fibromyalgia, and chronic fatigue syndrome.

Epstein Barr Virus (EBV); Belongs to the family of herpes viruses including those that cause cold sores, genital herpes, chickenpox and shingles. Infection with EBV is virtually inescapable; in the US, 95% of all adults will be infected by age 40, and 50% of all children by age 5. Many people don't realize they have been infected because they never feel sick. Once infected however, you harbor the virus for good.

Influenza A Virus
Causes influenza in birds and some mammals, and is the only species of influenza virus A. Influenza virus A is a genus of the Orthomyxoviridae family of viruses. Strains of all subtypes of influenza A virus have been isolated from wild birds, although disease is uncommon. Some isolates of influenza A virus cause severe disease both in domestic poultry and, rarely, in humans. Occasionally, viruses are transmitted from wild aquatic birds to domestic poultry, and this may cause an outbreak or give rise to human influenza pandemics.

Influenza A viruses are negative-sense, single-stranded, segmented RNA viruses. The several subtypes are labeled according to an H number (for the type of hemagglutinin) and an N number (for the type of neuraminidase). There are 18 different known H antigens (H1 to H18) and 11 different known N antigens (N1 to N11). H17 was isolated from fruit bats in 2012. H18N11 was discovered in a Peruvian bat in 2013.
Each virus subtype has mutated into a variety of strains with differing pathogenic profiles; some are pathogenic to one species but not others, some are pathogenic to multiple species.

Influenza B
Influenza Virus B is a genus in the virus family Orthomyxoviridae. The only species in this genus is called Influenza B virus. Influenza B viruses are only known to infect humans and seals, giving them influenza. This limited host and range is apparently responsible for the lack of Influenza Virus B-caused influenza pandemics in contrast with those caused by the morphologically similar Influenza Virus A as both mutate by both antigenic drift and reassortment.

Currently there are two co-circulating lineages of the Influenza B virus based on the antigenic properties of the surface glycoprotein hemagglutinin. The lineages are termed B/Yamagata/16/88-like and B/Victoria/2/87-like viruses. The quadrivalent influenza vaccine licensed by the CDC is currently designed to protect against both co-circulating lineages and has been shown to have greater effectiveness in prevention of influenza caused by influenza B virus than the previous trivalent vaccine.

Further diminishing the impact of this virus "in man, influenza B viruses evolve slower than A viruses and faster than C viruses". Influenza Virus B mutates at a rate 2 to 3 times slower than

type A. It is currently accepted that influenza B viruses cause significant morbidity and mortality worldwide, and significantly impacts adolescents and schoolchildren.

Influenza C

Influenza viruses are members of the family Orthomyxoviridae. Influenza C viruses are known to infect humans and pigs. This virus may be spread from person to person through respiratory droplets or by fomites (non-living material) due to its ability to survive on surfaces for short durations. Influenza viruses have a relatively short incubation period (lapse of time from exposure to pathogens to the appearance of symptoms) of 18-72 hours and infect the epithelial cells of the respiratory tract. Influenza virus C tends to cause mild upper respiratory infections. Cold-like symptoms are associated with the virus including fever (38-40^{o}C), dry cough, rhinorrhea (nasal discharge), headache, muscle pain, and achiness. The virus may lead to more severe infections such as bronchitis and pneumonia.

After an individual becomes infected, the immune system develops antibodies against that infectious agent. This is the body's main source of protection. Most children between five and ten years old have already produced antibodies for influenza virus C. As with all influenza viruses, type C affects individuals of all ages, but is most severe in young children, the elderly and individuals with underlying health problems. Young children have less prior exposure and have not developed the antibodies and the elderly have less effective immune systems. Influenza virus infections have one of the highest preventable mortalities in many countries of the world.

Parainfluenza

Parainfluenza refers to a group of viruses called human parainfluenza viruses (HPIVs). There are four viruses in this group. Each one causes different symptoms and illnesses. All forms of HPIV cause an infection in either the upper or lower respiratory area of the body.

Symptoms of HPIVs are like those of the common cold. When cases are mild, the viruses are often misdiagnosed. Most healthy people infected with an HPIV recover with no treatment. A person with a weakened immune system is at risk for developing a life-threatening infection. There are four different types of HPIV. They all cause a respiratory infection, but the type of infection, symptoms, and location of the infection depend on the type of virus you have. The four types of HPIV can infect anyone.

> HPIV-1 is the leading cause of croup in children. Croup is a respiratory illness that manifests as swelling near the vocal cords and in other parts of the upper respiratory system. HPIV-1 is responsible for outbreaks of croup in the autumn. In the United States, the outbreaks tend to be more widespread in odd-numbered years.
>
> HPIV-2 causes croup in children, but doctors detect it much less often than HPIV-1. It's seen mostly in the autumn but to a lesser degree than HPIV-1.

HPIV-3 is mostly associated with pneumonia and bronchiolitis, which is swelling from inflammation in the smallest airways in the lungs. It often causes infections in the spring and early summer, but it appears in people throughout the year.

HPIV-4 is rarer than the other types. Unlike the other strains of HPIV, there are no known seasonal patterns of HPIV-4.

Respiratory Syncytial Virus (RSV)
This common cold virus causing bronchiolitis in children, can act as a 'hit and hide' virus. The virus can survive for many months or years, perhaps causing long-term effects on health, such as damage to the lungs. Like a cold virus, RSV attacks your nose, eyes, throat, and lungs. It spreads like a cold too, when you cough, sneeze, or share food or drinks.

There are many kinds of RSV, so your body never becomes immune to it. You can get it again and again throughout your life, sometimes during the same season.
RSV usually causes the same symptoms as a bad cold, such as a cough, a stuffy or runny nose, a mild sore throat, an earache, and a fever. Babies with RSV may also have no energy, act fussy or cranky and be less hungry than usual. Some children have more serious symptoms like wheezing.

Varicella-zoster (Chickenpox)
This is a highly contagious disease, also from the herpes family, characterized by an itchy skin rash and fever. Chickenpox usually begins with mild constitutional symptoms such as a mild headache, moderate fever and discomfort followed by an eruption appearing in itchy groups of flat or elevated spots and blisters, which form crusts. The virus lies dormant in individuals who have had chickenpox as children. Shingles is a painful localized recurrence of the skin rash during adulthood. Shingles occur because the virus is reactivated.