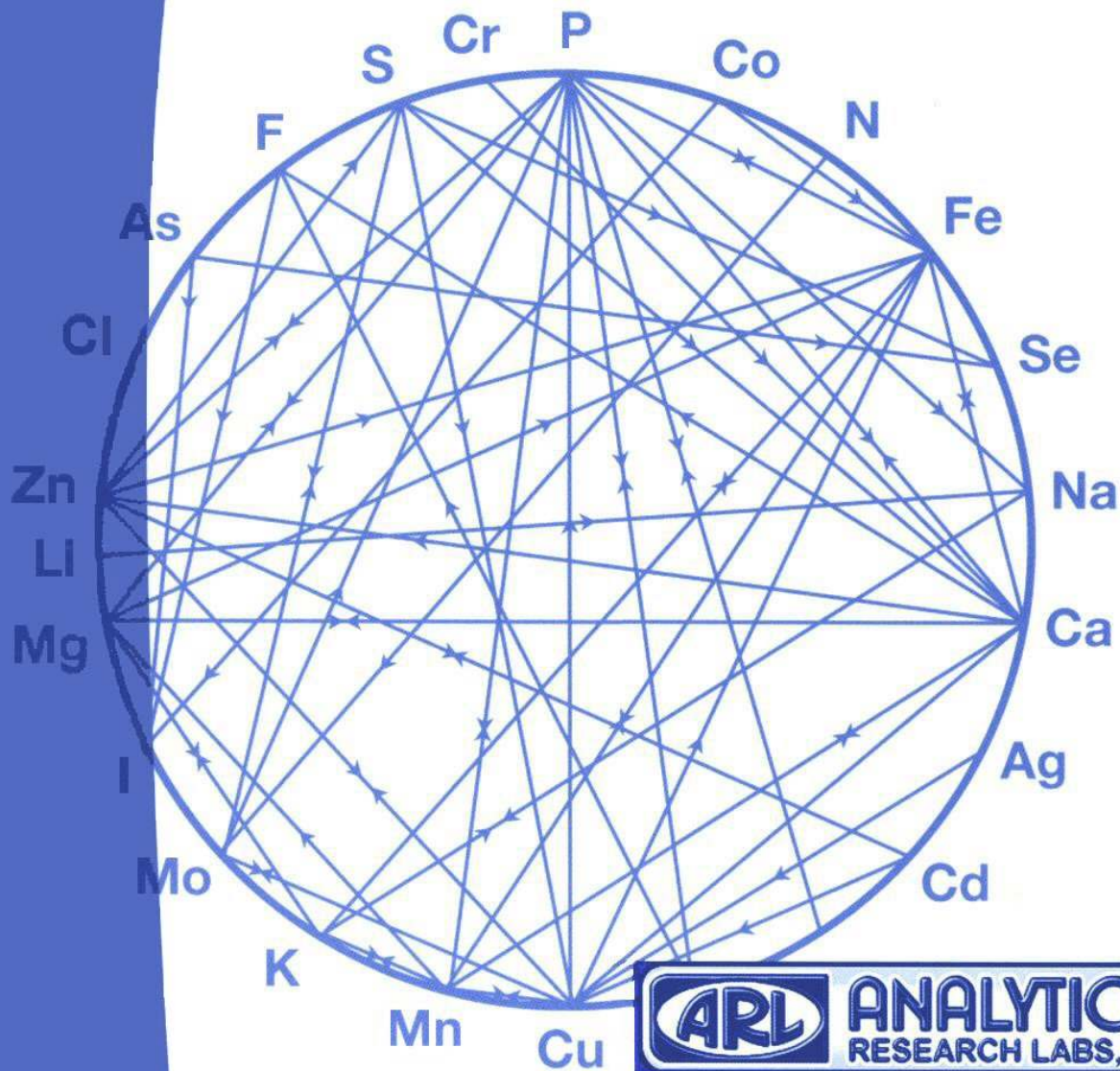


# Tissue Mineral Analysis



2225 W. Alice Ave. Phoenix, AZ 85021

## Doctor Sample

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## Joe Sample

Patient: Joe Sample  
Sex: M  
Age: 28  
Lab #60328

# HAIR TISSUE MINERAL ANALYSIS

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## **INTRODUCTION TO HAIR TISSUE MINERAL ANALYSIS**

A hair tissue mineral analysis (HTMA) is a screening test that measures the levels of twenty-one minerals and toxic metals present in a sample of hair. Minerals are the “spark plugs” of life and play many important health related roles within the human body. Providing a “window into the cells”, hair makes an excellent biopsy material and reveals a clear record of mineral metabolism. Hair, like all other body tissues, contains minerals that are deposited as the hair grows. Although the hair is dead, the minerals remain as the hair continues to grow. The minerals and toxic metals are locked inside the hair during the growth stage as the body uses it for the storage and elimination of minerals.

A hair tissue mineral analysis reflects long term metabolic activity as it measures an average of mineral accumulation over a three month period of time. This is often an advantage as the test results are not influenced by day-to-day variations in body chemistry due to stress, diet or other factors. Creating a blueprint of one’s individual biochemistry, a hair tissue mineral analysis can assist in identifying mineral patterns which may be associated with stress, blood sugar and carbohydrate imbalances, metabolic rate, biochemical energy production, and glandular imbalances. Hair tissue mineral analysis is used worldwide to measure environmental contamination with toxic metals in the soil, plants and human and animal populations.<sup>(1,8,13,20,31,35,40,44)</sup>

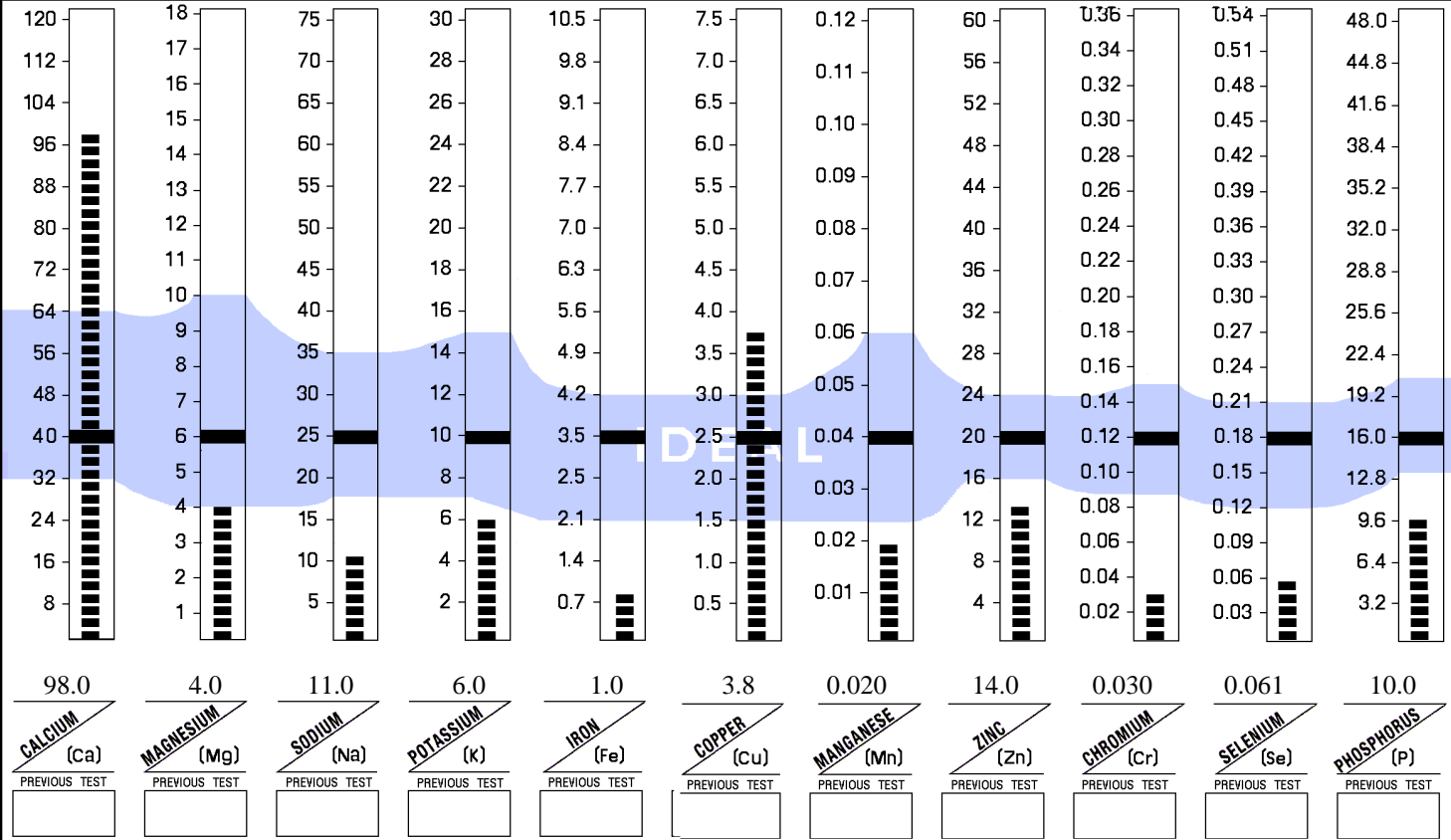
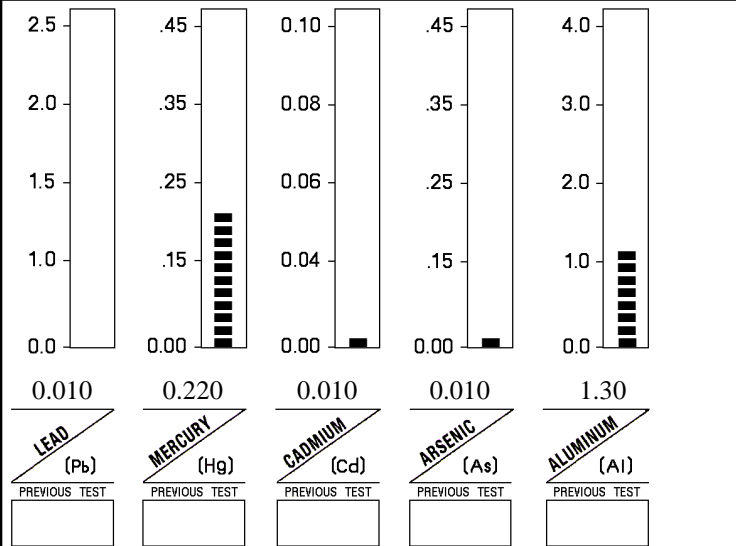
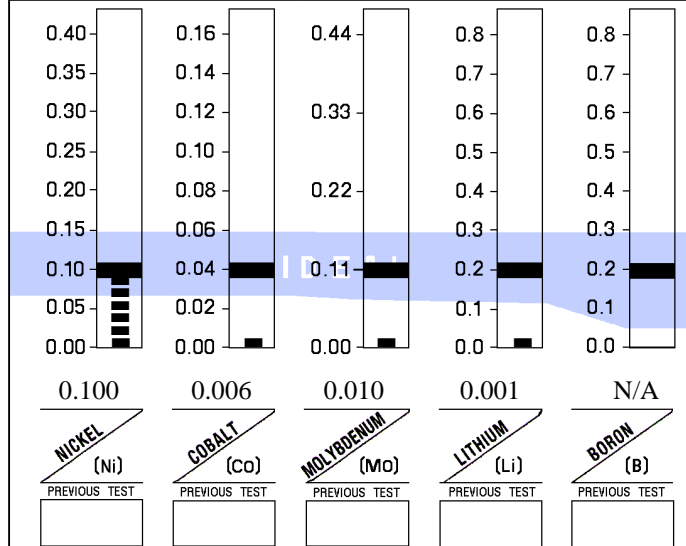
Screening tests (like all tests) do have limitations and ideally should be used in conjunction with other laboratory tests, medical histories and physical examinations. This test is provided to assist the health care professional in identifying nutritional and toxic elements that play a role in human health. The contents of this analysis are not intended to be diagnostic.

## **UNDERSTANDING YOUR RESULTS/LABORATORY NOTES**

The accuracy and reliability of the test results and interpretation is based directly upon the laboratory receiving a properly collected hair sample that is clean and free from external contaminants. It is difficult for the laboratory to make a determination as to whether the sample was taken properly. Accordingly, the laboratory assumes no responsibility for results from an improperly submitted hair sample.

- Test results - The ideal values for minerals are indicated by the gray bands, i.e. calcium 40 mgs%, magnesium 6 mgs%, sodium 25 mgs%, potassium 10 mgs%, etc. Your mineral values are printed directly above the name of each mineral. The black rectangle blocks represent a bar graph showing where your values lie in relation to the ideal values. Significant mineral ratios and your oxidation rate are located at the bottom of the graph.
- Reference ranges (blue shaded area) indicated on the graph of test results represent statistical “ideal” levels. These reference ranges should not be considered as absolute in considering mineral excesses, deficiencies or toxic levels of elements.
- The results of the hair tissue mineral analysis are reported in milligrams percent (mg%) or milligrams per 100 grams of hair.
- Accutrace Laboratories, Inc., a wholly owned subsidiary of Analytical Research Laboratories, Inc., automatically retests any mineral levels that are found to be outside an expected range of results, provided enough hair is available for this process.
- Test results were obtained using sophisticated ICP-MS instrumentation and procedures in a clinical laboratory environment with government regulatory standards outlined by the Department of Health and Human Services under the Clinical Laboratory Improvement Amendment (CLIA).

PATIENT NAME: **Joe Sample** Doctor Sample  
 SEX: **M** AGE: **28** DATE: **7/25/2012** LAB NO. **60328** CLIENT ACCT. NO. **4**

**NUTRIENT MINERALS**

**TOXIC METALS**

**ADDITIONAL MINERALS**

**SIGNIFICANT MINERAL RATIOS**

MINERAL RATIO	IDEAL RATIO	CURRENT RATIO	% OF IDEAL	PREVIOUS RATIO	LOW		IDEAL	HIGH	
					○	○	○	○	○
CA/MG	6.67	24.50	367		○	○	○	○	○
CA/K	4.00	16.33	408		○	○	○	○	○
NA/MG	4.17	2.75	66		○	○	○	○	○
NA/K	2.50	1.83	73		○	○	○	○	○
ZN/CU	8.00	3.68	46		○	○	○	○	○
CA/P	2.50	9.80	392		○	○	○	○	○

MIXED OXIDIZER  FAST OXIDIZER  SLOW OXIDIZER \*\*\*

## **INTERPRETATION OF YOUR TEST RESULTS**

The interpretation of your hair tissue mineral analysis depends upon developing a “metabolic blueprint” of how the body is responding to stress. The ability to determine the stage of stress <sup>(42)</sup> and the oxidation rate <sup>(48)</sup> from a hair tissue mineral analysis makes it possible to assess the likelihood of many conditions and guide correction based upon your metabolic imbalances. A thorough interpretation of the tests results also requires the identification of mineral levels, ratios and metabolic patterns.

### **METABOLIC PATTERNS**

A metabolic pattern is a combination of mineral levels and/or mineral ratios that reveal how the body is responding to stress. Identifying metabolic patterns simplify the interpretation as the science of mineral balancing is almost always aimed at improving major metabolic patterns and not a single mineral. A general rule is that metabolic patterns are the most important factors to consider when interpreting a hair tissue mineral analysis, followed by mineral ratios and mineral levels. Ratios represent mineral relationships and balances in the body.

### **OXIDATION RATE**

The term “oxidation rate” refers to the “burning” of foods in the body or how the body converts the foods you eat to energy. There are three types of oxidation rates, slow oxidation, fast oxidation and mixed oxidation. There are varying degrees of each oxidation rate and ideally it would be best to have either a slightly slow or slightly fast oxidation rate.

#### **Slow Oxidation**

A slow oxidizer is an individual who metabolizes food at a rate slower than that required for the production of optimal energy levels to adequately perform basic body functions. In slow oxidation the activity of both the adrenal and thyroid glands is less than optimal. Slow oxidizers often experience some degree of fatigue, lack of energy, sugar cravings, low blood sugar levels, constipation, weight gain, dry skin and depression.

#### **Fast Oxidation**

A fast oxidizer is an individual who metabolizes food at a rate faster than ideally required for the production of optimal energy levels to adequately perform basic body functions. Although this results in higher energy levels, the energy generated is temporary and is dissipated rather quickly. Fast oxidation is generally characterized by excessive activity of the adrenal and thyroid glands. Fast oxidizers often experience some degree of anxiety, irritability, elevated blood sugar levels, elevated blood pressure, oily skin and a tendency for frequent bowel movements.

#### **Mixed Oxidation**

A mixed oxidizer is an individual who metabolizes food at a rate that fluctuates between slow and fast oxidation. There are two types of mixed oxidation - slow/mixed oxidation and fast/mixed oxidation. Mixed oxidation is normally a transitory state of oxidation and is moving toward a state of slow or fast oxidation. Mixed oxidizers often experience a combination of symptoms associated with both fast and slow oxidation.

- ▶ Your hair tissue mineral analysis indicates a significantly slow oxidation rate.

## **STRESS AND ITS EFFECT ON HUMAN ENERGY AND HEALTH**

Stress is the response of the body to any physical or emotional stimulus and may be both harmful or beneficial, depending upon the type and intensity of the stressor. For example, exercise places stress upon the bones and muscles and keeps them strong. Stress that is controlled and limited also serves a very useful purpose by driving us to lead more productive and creative lives. However, constant stress, such as financial worries, job-related pressures, family issues, etc., will have a negative effect on your health and result in the depletion of essential energy producing trace minerals and vitamins. Without these energy producing minerals and vitamins the ability to cope with stress decreases and a cycle of declining health begins. Excessive stress is often associated with many health related issues and may also lead to the premature aging of the body.

The body reacts to stress by mobilizing all of its available energy. If adequate levels of energy can be mobilized to overcome the stress, health and well-being are restored. However, if the body cannot produce enough energy to overcome the stress, the body automatically reacts to it with a general adaptation syndrome consisting of three distinct stages. Hans Selye, M.D., identified these stages as the *alarm* stage, the *resistance* stage and the *exhaustion* stage. <sup>(11,42,51)</sup> The *Stress Theory of Disease* states that the body passes through these three stages as it comes under prolonged stress. Each stage has a particular biochemistry and specific conditions. Understanding the stage of stress can assist in guiding its correction from a less healthy and lower energy stage of stress to a more healthy and higher energy stage.

### **Alarm Stage**

The alarm stage of stress is considered an early stage of stress in which the body has adequate energy to fight back against the stress. It is often associated with activation of the sympathetic nervous system, a fast oxidation rate, higher blood pressure and blood sugar, higher body temperature and more frequent bowel movements. The body reacts to acute stress by releasing hormones produced by the adrenal glands which mobilize the body's energy to meet and overcome the stress.

### **Resistance Stage**

The resistance stage of stress occurs as the body attempts to adapt to the stress when it can no longer maintain an alarm stage. This stage of stress is best described as an endless battle, with the body attempting to contain the stress as it's unable to eliminate it. The resistance stage of adaptation can go on for a long period of time in an effort to limit or minimize the stress. The body still has some energy reserves available to resist stress, though less than in the alarm stage.

### **Exhaustion Stage**

The exhaustion stage of stress occurs when the body has exhausted its energy levels in an attempt to contain the stress. In this stage, the body no longer has the necessary energy reserves to resist or contain the stress and is now in a holding pattern to prevent a further decline in health. Symptoms may include fatigue, depression, apathy, despair, constipation, dry skin and hair, adrenal exhaustion and at times less than optimal thyroid activity. This is the most common stage of stress among adults today.

- ▶ Your hair tissue mineral analysis indicates your body is presently in the *exhaustion stage* of stress.

## **ENERGY PRODUCTION AND YOUR GLANDULAR SYSTEM**

The adrenal and thyroid glands are the main energy-producing organs in the body. They work together to release simple sugars from the liver and then process them into energy. These glands need to be functioning at optimal levels to have the maximum amount of energy possible.

The adrenal and thyroid glands also determine the rate of metabolism or oxidation rate. If both of these glands are underactive, an individual will generally be in a state of slow oxidation. A slow oxidizer will have a lowered rate of metabolism and normally will experience fatigue or a lack of energy. If the adrenal and thyroid glands are overactive, an individual will generally be in a state of fast oxidation and experience an abundance of energy, but only for limited amounts of time. If one of the glands is underactive and the other overactive then an individual will be in a state of mixed oxidation and at times may experience both a lack of energy and then a burst of energy.

The adrenal glands are also responsible for providing extra *energy* when needed. In an emergency situation, it is the adrenal glands that release the hormone adrenaline which generates a sudden increase in energy.

Finally, adrenal hormones are required for maintaining normal blood pressure and blood sugar, combating inflammation, carbohydrate metabolism and to activate the body's response to stress. The adrenal glands are also the sole source of female hormones after natural or surgically-induced menopause (20).

- ▶ Your hair tissue mineral analysis indicates a pattern of diminished cellular adrenal glandular activity. This may be due to chronic stress, toxic metals, nutrient deficiencies, fear or other stress related factors. Diminished adrenal gland activity may contribute to symptoms of fatigue, exhaustion, depression, mood swings and PMS or menopausal symptoms in women.

Weak adrenal gland activity may also contribute greatly to the accumulation of heavy metals as normal detoxification mechanisms become impaired. The body may compensate for adrenal weakness by retaining excessive amounts of copper, iron, manganese, aluminum, chromium, lead, cadmium, arsenic and other toxic metals.

- ▶ Your hair tissue mineral analysis indicates a cellular thyroid effect that is outside an optimal range. This may possibly contribute to fatigue, weight gain, dry skin, brittle hair, depression, a tendency for infections, low body temperature, low blood pressure and low blood sugar. Common causes of thyroid activity outside the optimal range include the presence of mercury, copper and chlorine toxicity, impaired adrenal activity, nutrient deficiencies and chronic stress.

## **SPECIAL METABOLIC PATTERNS**

### **Low Sodium/Potassium (Na/K) (Inversion) Ratio**

A sodium/potassium inversion is the single most important imbalance on a hair tissue mineral analysis. This indicates a reduced vitality and impaired electrical balance within the cells. Sodium is an extracellular element while potassium belongs inside the cells. A decrease in the ratio indicates a loss of potassium into the interstitial spaces as cells are destroyed.

This low ratio is often associated with adrenal exhaustion, infections and impaired sugar and carbohydrate tolerance. The body is unable to burn glucose properly to produce energy and begins to cannibalize body proteins. This is not only inefficient, but may contribute to many detrimental conditions. (11,51)

Tissue breakdown, or catabolism, is a common finding in individuals exhibiting a low sodium/potassium ratio.



A low sodium/potassium ratio often results in an inability to properly digest and utilize foods consumed thus resulting in the body breaking down storage tissues (protein) in an effort to maintain adequate energy levels and a state of equilibrium of the metabolic process (homeostasis). In other words, body proteins are broken down into amino acids for conversion into sugars in order to produce energy. Enhancing your ability to properly metabolize sugars and simple carbohydrates should, by reducing protein catabolism, be most beneficial.

The pattern is also associated with liver and kidney stress, allergies and impaired digestion. Balancing this ratio is a major focus of your recommended dietary, supplement, lifestyle and detoxification program.

### **Adrenal Insufficiency**

An adrenal insufficiency is depicted on a hair analysis chart by low levels of both sodium and potassium. An adrenal insufficiency is a reduced ability to mobilize defenses against stress. The body is still able to *adapt to stress*, but with a limited response. In addition, an adrenal insufficiency refers to the inability of the adrenal glands to produce a normal quantity of hormones. The major hormones produced by the adrenal cortex are aldosterone and cortisol. A balance between aldosterone and cortisol is necessary to maintain one's health.

- ▶ Your chart reveals low sodium and potassium levels which are associated with a degree of adrenal insufficiency, underactivity of the adrenal glands.

### **Copper Imbalance**

A copper imbalance is so common and so important that it is identified as a major pattern on a hair tissue mineral analysis. Many of the most prevalent metabolic dysfunctions of our time are related in some way to a copper imbalance. A copper imbalance is often associated with fatigue, emotional sensitivity, depression, mood swings, anxiety, insomnia, skin conditions, yeast infections and many other disorders. See additional comments under "Nutrient Mineral Patterns".

## **DIETARY PATTERNS**

### **Sugar and Carbohydrate Tolerance**

The excessive intake of carbohydrates in the diet is often associated with the development of many health conditions including, glucose (sugar) metabolism, digestive difficulties, yeast infections, fatigue, depression and others. Excessive carbohydrates may also upset the balance between calcium and phosphorus and between calcium and magnesium. (3,7,11,15,18,33,37,44,48,49,54,55)

Inasmuch as the release of insulin is promoted by calcium and inhibited by magnesium, the proper ratio of calcium to magnesium is critical for optimal insulin secretion, thus resulting in one's ability to properly metabolize sugars and simple carbohydrates.

The adrenal glands also play a major role in regulating carbohydrate metabolism in the body. A low sodium/potassium ratio is indicative of excessive glucocorticoid production. Potassium reflects glucocorticoid levels (regulates glucose metabolism), while sodium reflects mineralocorticoid levels (regulates salt and water balance). When the mineralocorticoid hormones get out of balance with the glucocorticoid hormones, an individual can also develop a sensitivity to the ingestion of sugars and simple carbohydrates.

Simply stated, one's inability to cope with stress is associated with a low sodium/potassium ratio. Being that a high potassium level relative to the sodium level represents an excess of sugar-raising hormones, a stress-induced sensitivity to the ingestion of sugar and simple carbohydrates occurs.



- ▶ Your hair tissue mineral analysis indicates an imbalanced glucose (sugar) metabolism as indicated by your elevated calcium/magnesium ratio and your low sodium/potassium ratio.

### **Protein Synthesis**

Adequate protein synthesis is vitally important for the regeneration of all body tissues. This requires proper digestion, absorption and utilization of proteins. Protein synthesis is influenced by the amount and type of protein consumed in the diet and by one's eating habits.

- An elevated phosphorus level is indicative of rapid protein breakdown, while a low phosphorus level indicates inadequate protein synthesis.
  - The mineral zinc must be singled out as particularly important for protein synthesis. It is required for the enzyme RNA transferase, a key step in protein synthesis.
  - A low sodium/potassium ratio reveals significant information regarding the individual's capability of utilizing protein. The lower the sodium/potassium ratio, the less protein can be synthesized.
- ▶ Your tissue mineral analysis indicates impaired protein synthesis at this time as indicated by your low phosphorus and zinc levels.
  - ▶ Since a low sodium/potassium ratio reveals significant information regarding an individual's capability in utilizing protein, your low sodium/potassium ratio is contributing to an impaired protein synthesis at this time.

### **Digestion**

Excellent digestion is a key to improving one's health. If digestion is impaired, even the best diet will not supply the body with needed nutrients. Additionally, improperly digested food will ferment or putrefy in the intestines and produce extremely toxic chemicals that are then absorbed into the body. Proper digestion depends on one's diet, eating habits, energy levels, digestive enzymes, bowel flora and the condition of the intestines.

- Phosphorus levels are highly indicative of one's ability to synthesize protein. The inability to synthesize protein frequently results in impaired digestion.
  - A low sodium/potassium ratio is indicative of an excessive stress situation, which will eventuate in a reduction in both hydrochloric acid and pancreatic digesting enzymes.
  - Extreme fast oxidation pattern is often associated with a tendency for excessive stomach acid secretion when under stress. This can result in poor digestion to some degree.
  - Zinc is required for all digestive enzyme production. It is also required to rebuild the fast-growing intestinal tissue, and for the production of bile and liver and pancreatic secretions.
  - Excessive tissue copper can result in poor digestion and poor motility of the bowel, hence resulting in food putrefaction resulting in gas and bloating often associated with poor digestion.
- ▶ Your hair tissue mineral analysis indicates impaired digestion, due in part to your;
    - ▶ low phosphorus level
    - ▶ low sodium/potassium ratio
    - ▶ high copper level
    - ▶ low zinc level

## **NERVOUS SYSTEM PATTERNS**

### **Autonomic State**

The autonomic nervous system regulates many functions in the body and consists of the sympathetic and parasympathetic branches. The sympathetic branch activates the brain, muscles and the thyroid and adrenal glands which enable the body to respond to stress. During the day, one primarily uses the sympathetic nervous system which is associated with expending energy and is catabolic, breaking down body tissues. <sup>(20)</sup> One is in a more sympathetic state when physically or mentally active.

The sympathetic branch of the nervous system is balanced by the parasympathetic branch which is associated with the nurturing and regeneration of body tissues. The parasympathetic branch also enhances digestion and the elimination of toxins. This branch is restful, conserving of energy and is anabolic or builds up new tissue. Healing requires that one spend sufficient time in a parasympathetic state to permit proper digestion, elimination of toxins and rebuilding of the body. <sup>(20,52)</sup> One is more parasympathetic when sleeping, resting or relaxing.

The vast majority of individuals today have either overactive sympathetic nervous systems or they have exhausted the sympathetic system from overusing it. These individuals often shift into an *unhealthy parasympathetic state* in which the body is exhausted and now is attempting to permit some degree of healing and regeneration. A high percentage of slow oxidizers fall into this category. Maintaining a proper balance between the sympathetic and parasympathetic branches is critical to your health. This allows you to conduct all the necessary functions of daily life and at the same time provide for the regeneration of the body.

Dr. Melvin Page, DDS studied the balance between calcium and phosphorus in serum and its relationship to the balance between the sympathetic and parasympathetic nervous systems. <sup>(33)</sup> The mineral balance between calcium and phosphorus reflects an average autonomic state over the past several months.

- ▶ Your hair tissue mineral analysis indicates your body is predominantly in a *parasympathetic state*. This is often due to the exhaustion of the sympathetic nervous system, which causes the body to shift to an *unhealthy parasympathetic state* to allow for some degree of healing and regeneration. General causes for this state include nutrient deficiencies, toxic metal excesses, excessive activity or mental patterns such as worrying, fears, anger or resentments.

To balance the autonomic nervous system, additional rest is required and it is important not to push yourself or work too hard as these activities stimulate the sympathetic nervous system.

## **ORGAN AND SYSTEMS PATTERNS**

### **Immune System Activity**

The immune system is a network of organs, cells and tissues that work together to provide the body's first line of defense against organisms, toxins and substances that invade our systems and cause disease. The immune system has many aspects including the health of the white blood cells, the digestive tract, cell membranes, antioxidant nutrients and the autonomic balance. Certain indicators on a hair tissue mineral analysis often reflect the overall condition of the immune system.

- A low sodium/potassium ratio results in an impaired immune system response, due to one's inability to adequately synthesize protein.
- A very high sodium/potassium ratio may indicate kidney stress and an imbalanced immune system. A high ratio

may indicate autoimmune problems, or an overactive immune system. Rheumatoid arthritis, Hashimoto's thyroiditis and lupus are examples of autoimmune diseases.

- A zinc deficiency, or loss, will impair immune system function. Zinc is involved in all protein synthesis and is required for the integrity of the skin and mucus membranes of the body, which are critical tissues in defending against infection.
  - Chronic over-activity of the adrenal glands in the "fast" oxidizer has a suppressive effect upon the thymus gland, thus impairing immune system function.
  - A copper imbalance often indicates impaired immune system function. Copper is required for energy production within the cells and mobilization of copper from the liver which is part of the normal infection-fighting mechanism of the body. The mineral itself is a fungicide and an anti-bacterial.
  - A low tissue zinc/copper ratio is frequently associated with an immune deficiency, due to excessive tissue copper displacing zinc, which is necessary for immune system function.
- ▶ Your hair tissue mineral analysis suggests an impaired immune system that may limit the body's ability to remain in a healthy state, due in part to your;
- ▶ low sodium/potassium ratio
  - ▶ zinc deficiency, or loss
  - ▶ Copper imbalance
  - ▶ Low tissue zinc/copper ratio

### Liver and Kidney Stress

The liver is the largest gland in the body and performs a large number of functions that impact all body systems. Some of the functions performed by the liver include the filtering of harmful substances from the blood, the storage of vitamins and minerals and the maintenance of proper blood sugar levels. The liver is also responsible for the production of cholesterol and other vital substances.

The main function of the kidneys are to separate toxins and other waste products from the blood. They are also involved with the regulation of blood pressure and maintaining the balance of water, salts and electrolytes.

Both the liver and kidneys are very important organs of detoxification and are common sites of toxic metal accumulation.

- Certain indicators on a hair tissue mineral analysis, i.e., *sodium/potassium ratio, excess tissue copper, high levels of iron and manganese, or the presence of toxic metals, such as; mercury, cadmium, arsenic and aluminum*, often reflect the overall condition of the kidneys and liver.
- ▶ Your hair tissue mineral analysis indicates a trend for liver and kidney stress. This may contribute to impaired toxic metal elimination, impaired immune system, carbohydrate intolerance, fluid imbalances and other conditions that may affect liver and kidney function.

### Inflammation

Inflammation is the body's normal reaction to an injury, disease, or the presence of a foreign substance. Inflammation is generally recognized by swelling, redness, heat, or possibly pain. If the body can overcome the causative factor, then the inflammation is reduced and the inflammatory process terminates. However, if the inflammatory process continues, inflammation can become chronic.

Acute inflammation generally causes an increase in adrenal activity and thus a rise in the secretion of the hormone aldosterone (sodium). Aldosterone is a pro-inflammatory hormone. Cortisol and cortisone (potassium) are anti-inflammatory hormones because they diminish inflammation. The pro-inflammatory and anti-inflammatory

hormones need to be in balance with each other for optimum health.<sup>(20)</sup>

Certain indicators on a hair tissue mineral analysis often reflect inflammation and/or an inflammatory response in the body.

- An elevated sodium/potassium ratio, as determined by a hair analysis, is an excellent indicator of the predominance of the pro-inflammatory hormones (represented by sodium on a hair analysis chart) over the anti-inflammatory hormones (represented by potassium).
  - A low sodium/potassium ratio, as determined by a hair analysis, is an excellent indicator of excessive protein catabolism (breakdown) which is frequently associated with an inflammatory condition such as arthritis. Degeneration of the joints causes inflammation and joint pain.
  - A magnesium deficiency relative to a high sodium level, as indicated by an elevated sodium/magnesium ratio on a hair analysis, is often associated with an inflammatory process.
  - Acute stress can result in an inflammatory reaction. Many factors can be the source of stress, such as a change in weather, change in diet, fatigue, toxic metal accumulation, emotional conflicts, etc.
  - A low potassium level represents inadequate glucocorticoid (anti-inflammatory) activity, which often contributes to an inflammatory tendency.
  - Copper, in excess, can result in a suppression of anti-inflammatory hormones. A deficiency of anti-inflammatory hormones is responsible for an inflammatory process.
  - Excess iron is known to deposit in the joints, resulting in an inflammation of the joints.
- ▶ Your hair tissue mineral analysis currently indicates the presence of an inflammatory tendency, as indicated by your;
- ▶ low sodium/potassium ratio
  - ▶ low potassium level
  - ▶ copper toxicity

### Cell Permeability

Cell permeability refers to the ability of substances to move into or out of the cell by crossing the cell membrane. Some substances are able to cross the membrane very easily and the membrane is said to be very permeable to these substances. Additionally, other substances move across with increased difficulty and others are excluded completely. In the latter case the cell membrane is impermeable to these substances. The correct degree of cell permeability is very important to maintaining excellent health. “Sodium and potassium tend to increase the cell’s exchanges and the entrance of water-soluble toxins. Calcium and magnesium tend to reverse this situation.” <sup>(27)</sup>

- ▶ Your hair tissue mineral analysis indicates significantly decreased cell permeability. This impairs the entrance of hormones, glucose and other substances into the cells. It also impairs the elimination of toxic substances from the cells. This may contribute to reduced adrenal gland activity, thyroid imbalance, cellular nutrient deficiencies, cellular toxicity and often symptoms of chronic low cellular glucose or insulin resistance.

### Behavioral Patterns

A fascinating area of hair tissue mineral analysis interpretation involves how minerals effect emotions and behavior. Minerals are associated with specific neurotransmitters and some settle in specific parts of the brain. <sup>(7, 18, 30, 31, 42, 43, 46)</sup>

- ▶ Your hair tissue mineral analysis indicates a pattern that may contribute to feelings of frustration, resentment or hostility. A low sodium/potassium ratio is often associated with chronic adrenal, kidney and liver stress which

in turn is often associated with these emotions.

## **ELECTROLYTE PATTERNS**

### **Calcium**

Calcium is found in every cell throughout the body. Over ninety percent is found stored in the bones and teeth. Calcium is regulated by the thyroid, parathyroid, adrenal and pituitary gland. It's use in the body is involved in maintaining the acid alkaline balance. It is necessary for normal blood clotting, nerve conduction, muscle contraction and relaxation, cell division, heart rate, and maintenance of the bones and teeth. It is a primary extra-cellular element.

Excellent quality bioavailable calcium is lacking in the diets of most people. The main food sources are raw and organic dairy products, carrots and carrot juice and a few other vegetable sources such as nuts and seeds. However, when cows milk is pasteurized and homogenized, calcium availability declines greatly. As a result, most people are not benefitting enough from the calcium in the milk, cheese and yogurt they are consuming.<sup>(51)</sup>

- ▶ Elevated calcium levels on a hair tissue mineral analysis do not necessarily indicate the presence of too much calcium in your diet, or in the body. Most often, it reflects abnormal calcium deposition in the hair and other soft tissues of the body. For this reason, calcium supplementation may be recommended.

An elevated calcium level may also serve as a stress-buffering mechanism. As calcium levels rise in the tissues, it often has a calming, or numbing effect on one's emotions and can serve to reduce, or protect one from stress.

In many cases, a high calcium level is indicative of a 'calcium bio-unavailability' which means it is present in the body but cannot be used properly.

### **Magnesium**

Magnesium is extremely important in keeping calcium in a bio-available form. In other words, magnesium is necessary for the utilization of calcium. Magnesium tends to follow calcium up and down.

Magnesium is required for the bones and nervous system. It is also essential for over 600 vital enzymatic reactions in the body. It is a primary intra-cellular element.<sup>(44)</sup>

- ▶ A low magnesium level on a hair tissue mineral analysis is often due to an excessive excretion of magnesium in the urine as part of an alarm stage response to stress.

### **Sodium**

Sodium is an essential mineral for maintaining water balance and blood pressure in the body and is a primary extra-cellular element.

- ▶ A low sodium level on a hair tissue mineral analysis is often associated with reduced sodium retention due to impaired adrenal gland activity. This may contribute to symptoms of fatigue and low blood pressure. A low sodium level does not necessarily mean one is consuming too little salt.

### **Potassium**

Potassium is a primary intra-cellular element required for fluid balance, nerve activity and muscle activity.

- ▶ A low potassium level on a hair tissue mineral analysis is often associated with excessive excretion of potassium due to stress and adrenal gland weakness. This may contribute to feelings of fatigue and low blood sugar.

## **NUTRIENT MINERAL PATTERNS**

### **Iron**

Iron is required in hemoglobin for transporting oxygen in the blood, for detoxification and for energy production in the cells. Iron is found in lean meats, organ meats, shellfish, molasses, beans, whole-grain cereals, and dark green vegetables.

- ▶ In most cases, a low iron level in the hair does not necessarily indicate a deficiency or lack of iron and often represents bio-unavailable iron. This means an excess of iron may be present in the liver or other organs, but is not revealed in the hair at this time. An iron imbalance is often associated with general fatigue.

### **Copper**

Copper is an essential mineral in the body and directly or indirectly affects virtually every bodily system function. Copper is required for energy production, cardiovascular health, neurotransmitter activity, female reproductive system, skin health, blood formation and the immune system.

- ▶ Your copper level is currently above an optimal range which indicates a copper toxicity, or an elimination of excess tissue copper. (See [Toxic Metals and Chemicals](#) section further on in this report for more information on this elevated level).

### **Manganese**

Manganese is essential for energy production, maintaining glucose metabolism, maintaining tendon and ligament integrity and is essential for bone development.

- ▶ A low manganese level is often associated with a manganese deficiency in the diet, especially if one consumes refined foods or white sugar.

### **Zinc**

Zinc is found in small quantities in the body (about two grams) and is essential for over 50 functions including all protein synthesis, growth and development, male reproductive system, insulin production and secretion, vision, digestion, prostate health, skin, hair and nail health, and immune system activity.

- ▶ A low zinc level can be due to any number of reasons; including an over consumption of sugars and simple carbohydrates, an acute stress situation, infection and/or the release of toxic metals, particularly copper.

Low zinc levels are often associated with mood swings, digestive disturbances, skin problems, vision problems, prostate problems in men and a reduced sense of taste and smell.

Low zinc levels may also be a compensatory effort by the body to help balance the sodium/potassium ratio.

### **Chromium**

Chromium enhances utilization of insulin, resulting in improved burning of glucose. Chromium is involved in maintaining blood sugar levels and energy levels. It is also associated with cholesterol regulation.

- ▶ A low chromium level may contribute to blood sugar imbalances, cravings for sweets or starches, fatigue, elevated cholesterol.

### **Selenium**

Selenium is required for thyroid function. Selenium is an essential component of the enzymes that convert Thyroxine (T4) to Triiodothyronine (T3). Selenium is also important in heavy metal detoxification and is also important in enhancing immune system function.

- ▶ A low selenium level may contribute to impaired detoxification and thyroid gland activity.

### **Phosphorus**

Phosphorus is an essential mineral that is involved in protein synthesis and energy production within the cells. All proteins contain phosphorus and thus are a significant source of organic phosphorus. The hair tissue mineral level of phosphorus is often associated with the adequacy of protein synthesis in the body. This depends on the diet, lifestyle, condition of the intestinal tract and liver and the levels of other nutritional minerals such as zinc and copper.

- ▶ A low hair tissue mineral phosphorus level indicates excessive protein catabolism or tissue breakdown. This may be due to improper diet with a low protein intake, inadequate protein quality, impaired digestion, imbalanced intestinal flora, intestinal infections such as candida albicans or other parasitic infections. Other considerations that may play a role in a low phosphorus level are a low zinc level or a hidden copper toxicity. These mineral imbalances can impair protein synthesis which requires a zinc dependent enzyme, RNA transferase. Improper eating habits that interfere with digestion may also contribute to your low phosphorus level at this time. Balancing the phosphorus level with dietary modifications, digestive enzymes and nutritional balancing is most important as adequate protein synthesis is important for the regeneration of all body tissues.

## **TOXIC METALS AND CHEMICALS**

The presence of toxic metals and chemicals can potentially present a serious health hazard. <sup>(1, 11,12,13,14,15,16,19,22,29,31,39,51)</sup>. A serious problem today is that a large number of babies are born high in toxic metals due to toxicity in the mothers. A review of over 400 medical studies by the US Environmental Protection Agency revealed that hair tissue mineral analysis is a meaningful test to detect toxic metals <sup>(47)</sup>.

Toxic metals can cause hundreds of symptoms and contribute to many serious health conditions. There are no safe levels of toxic metals and reducing the presence of toxic metals is a primary goal of your nutritional balancing program.

Seven different methods are used simultaneously in your recommended dietary, supplement and lifestyle program to assist in the reduction of toxic metals. These are 1) improve your energy level, 2) provide support for the organs of elimination, 3) inhibit the sympathetic nervous system, 4) reduce exposure, 5) supplement with heavy metal antagonists, 6) supplement with natural heavy metal chelators and 7) recommend other natural detoxification methods.

The hair tissue mineral analysis does not test for toxic chemicals such as pesticides and solvents. However, enhancing energy production, inhibiting the sympathetic nervous system, assisting the organs of elimination and reducing exposure to all toxins greatly assists the removal of toxic chemicals from the body.

Hair tissue mineral analysis only detects metals present in the hair tissue. No test can detect all toxic metals, as some are hidden deep within other tissues or organs. The unique value of hair mineral tissue mineral analysis is not so much to detect toxic metals, but to guide the balancing of body chemistry to assure their safe and swift removal. When the seven methods above are combined, the metals will be removed without the need for synthetic chelators.

Toxic metals are often layered deep within body tissues. The recommended diet, supplement, lifestyle and



detoxification program will slowly release layer after layer. Hidden metals will often be revealed on future mineral tests as they are eliminated through the hair, skin and through other routes.

### **Copper**

An elevated copper level is indicative of an excess of tissue copper, or copper toxicity. Copper tends to accumulate in the liver, brain and the kidneys, which are in essence, storage organs to prevent excessive amounts of copper from accumulating in the blood.

An elevated copper level on a hair tissue mineral analysis indicates a condition of bio-unavailable copper. Although copper is present in excess in body tissues, it cannot be utilized properly.

Due to the intimate relationship between zinc and copper, if a hair analysis indicates a low zinc/copper ratio, a copper toxicity must also be considered.

A copper imbalance can result from underactive adrenal gland activity, a zinc deficiency, environmental copper exposure and congenital copper toxicity transmitted through the placenta.

- ▶ Your high copper level indicates an excess of copper in the tissues, or copper toxicity. Research reveals that excess tissue copper is often directly related to numerous emotional and physical symptoms.

### **Mercury**

Mercury can enter the body through the lungs, through food and water and by direct physical contact. Because mercury can affect numerous other minerals in the body, it is often associated with various physical and emotional symptoms.

Sources of mercury include dental amalgams (silver fillings), contaminated fish and shellfish, contact lens solutions, vaccines, flu shots, occupational exposure and contaminated air and water.

Mercury toxicity may contribute to nervousness, irritability, immune system dysfunction, thyroid imbalance, tremors, autism, ADHD, hyperactivity and other behavioral difficulties.

- ▶ Your hair analysis indicates a high mercury level at this time.

### **Cadmium**

Cadmium is an extremely toxic metal which has no known necessary function in the body. As with other toxic metals, cadmium can be so tightly bound that it may require an improvement in one's body chemistry before it is released from the kidney, liver and various other organs.

Sources of cadmium include junk food, margarine, tap water, cigarette and marijuana smoke, industrial exposure, contaminated shellfish and coffee drinking.

Cadmium toxicity may contribute to symptoms of joint pain, kidney disease, hypertension, fatigue, cardiovascular disease and anti-social behavior.

- ▶ Your hair analysis reveals a presence of cadmium in the tissues at this time.

### **Aluminum**

Aluminum is the third most prevalent element and the most abundant metal in the earth's crust. Individuals are naturally exposed to relatively large amounts of aluminum from food, water and air.

Common sources of aluminum include; aluminum cans, aluminum food containers, aluminum foil used in cooking, aluminum cookware, anti-perspirants, antacids, table salt, some baking powder/baking soda and tea.

Aluminum is mainly stored in the lungs, liver, thyroid, bone and brain. Aluminum toxicity may contribute to

memory loss, dementia, fatigue, behavior difficulties and skin rashes.

- ▶ Your hair analysis reveals a presence of aluminum in the tissues at this time.

## **DETOXIFICATION**

In addition to your dietary, lifestyle and supplement recommendations, sauna baths can be extremely helpful for heavy metal detoxification.<sup>(39,52)</sup> Electric light infrared saunas have been found to provide the most beneficial results. Saunas are often more effective for heavy metal detoxification than steam baths, hot tubs or tub baths, by stimulating the skin, the largest organ of detoxification. They also help enhance circulation and oxygenation of the body. The best times for sauna baths are first thing in the morning or last thing at night.

## **METABOLIC TRENDS**

Mineral research by Dr. Paul C. Eck and others indicates that certain patterns on a hair tissue mineral analysis may often be associated with a particular health condition.<sup>(7,11,51)</sup> We refer to these mineral patterns as metabolic trends. Metabolic trends are not intended to be diagnostic in nature and they do not necessarily indicate that such a trend is currently present. Metabolic trends often indicate that if your present mineral levels, ratios and patterns continue as they are for a long enough period of time, it is possible you may develop these conditions. Your hair tissue mineral analysis indicates tendencies for the following metabolic trends.

### **Adrenal Insufficiency**

This is the reduced activity or response of the adrenal glands and is often associated with chronic stress or nutritional deficiencies. A slow or slow-mixed oxidation rate is closely associated with reduced cellular gland activity.

### **Allergies**

Allergies are hypersensitive states of the body that occur in response to exposure to chemical or biological substances in the environment. Less than optimal adrenal glandular activity is often associated with a tendency for allergies.

### **Allergies (Food)**

These are hypersensitive states of the body in response to eating specific foods. They can cause many symptoms from abdominal distress and diarrhea to hay fever and flushing.

### **Anemia**

Anemia is a reduction in the number of red blood cells per cubic millimeter, in the quantity of hemoglobin or in the volume of red blood cells.

### **Depression**

This is a condition often associated with a dejected mood, insomnia, fatigue, guilt feelings or preoccupations.

### **Emotional Sensitivity**

This is an excessive emotional response, and may include excessive weepiness, moodiness, anger, hostility,

irritability or depression.

### **Fatigue**

Fatigue is a loss of energy or the power to respond to the environment. Symptoms may include reduced muscular strength, stamina or endurance, impaired cognition and a reduced emotional response. Fatigue is often associated with a slow or slow-mixed oxidation rate.

### **Glucose Intolerance**

Glucose tolerance is the ability of the body to metabolize glucose, a form of sugar. Sugar intolerance occurs when ingested sugar causes an excessive increase in blood sugar and often excessive insulin secretion.

### **Hypothyroidism**

Hypothyroidism is a reduced level of thyroid activity and is often associated with chronic stress and nutritional deficiencies.

### **Infections**

Infections are invasions and increases in the body of bacteria, fungi, viruses, parasites or other microorganisms. They result in cellular injury due to toxins and other mechanisms.

### **Insomnia**

Insomnia is difficulty falling asleep or staying asleep.

### **Kidney Stress**

The kidneys regulate the composition of the blood by removing wastes and toxic substances. Kidney dysfunctions due to excessive stress may involve improper filtering of the blood, resulting in a variety of possible health conditions.

### **Liver Stress**

The liver performs over 500 functions, ranging from amino acid synthesis and glycogen storage to detoxification. Excessive stress on the liver may hinder the performance of various liver functions.

## **GENERAL INFORMATION**

### **Balancing Body Chemistry**

Balancing body chemistry requires time. In many cases, vital minerals have been replaced in the body tissues with toxic metals such as lead, cadmium, mercury, aluminum and others. These toxic metals are often bound in the tissues and may not show up on your initial hair tissue mineral analysis. The process of corrective healing and rebuilding of body chemistry may require many months to even years depending on your condition at the beginning of the program. It is a well known fact that it often takes six months to replenish one mineral, such as iron (reserves) in an individual with iron deficiency anemia. Additional factors such as diet, lifestyle, stress and medications can all alter mineral levels and ratios and can affect the rate of improvement.

### General Dietary Principles

For the slow and slow-mixed oxidizer, general dietary principles to follow are:

- Higher amounts of low-fat protein foods - such as small fish, fowl, bean and grain combinations, eggs and lean meats.
- Lower dietary intake of fat.
- Moderate amounts of unrefined carbohydrates - such as whole grains and whole grain products, legumes (beans, peas, lentils), root vegetables (potatoes, yams, etc.), squash.
- Avoid or eat sparingly: fatty meats and foods high in fat content, organ meats (high purine content), and dairy products (high fat content).
- Eat plenty of vegetables with at least two of your meals per day.

Both the supplement and dietary recommendations are important for the eventual success of your program. For a thorough explanation of the optimum diet for you, we recommend our personal diet plan - "An Eating Plan for Optimal Health" (Profile V), which is designed to aid in the balancing of your particular biochemical imbalances. This dietary concept provides three transition stages of dietary recommendations based upon metabolic (oxidation) rate, individual mineral readings and ratios and symptom based food recommendations. The eating plan provides two entry level stages (Introductory and Intermediate) of transition diets on your way to the final and third stage "Optimal Diet". This allows you to begin with a dietary transition level you feel comfortable with before moving on to the Optimal Diet. Our easy to follow plan also emphasizes the benefits of good eating habits and quality food selections.

### Eating Habits

- Eating habits are as important as what you eat.
- Eat regular meals, at set times during the day if possible.
- Allow time for meals, sit down to eat, refrain from eating on the run.
- Chew your food thoroughly, eat slowly and relax for at least 10 minutes after eating before returning to work or other activities.
- Food should be as fresh as possible and organically grown if possible. Simple food combinations can favorably assist digestion.

### Lifestyle

A healthy lifestyle will significantly enhance the speed at which your body chemistry will return to a balanced state. An unhealthy lifestyle will definitely slow progress.

Important Elements Of Lifestyle Are:

**Sleep:** Getting plenty of sleep and rest is absolutely essential to obtain the best results possible from the program. Most healing takes place while you sleep. Sleep and rest allow your body to utilize the healthier foods and supplementary nutrients you are providing. We cannot emphasize enough the importance of getting proper amounts of sleep and rest. Eight to ten hours of sleep per night and a rest or nap of about 20 minutes per day will enhance the effectiveness of the nutrition program.

Individuals with adrenal insufficiency may find that the more they sleep, the worse they feel, especially upon arising. This occurs because their exhausted adrenal glands further slow down during sleep and upon awakening, the adrenal glands are functioning more slowly than when they went to bed. In these instances, it may be preferable to take short naps or rest periods several times a day if needed, no more than 20 minutes each, rather than sleep more hours at night.

Some people are reluctant to go to bed. By the end of the day, the adrenal glands finally become active, due to being 'whipped' all day. Such a person feels more alive in the evening (night people) and hence they are reluctant to go to bed. The solution to the above problem is to realize that the goal is to have normally functioning adrenal glands all day, without the need to 'whip up' the glands with coffee, exercise, mental stress or alcohol.

By enhancing body chemistry and obtaining adequate rest, reactivation of the adrenal glands may be accomplished over a period of time.

**Exercise:** Perform some type of gentle physical activity every day. Strenuous exercise is not necessary or recommended at this time. Light exercise such as walking, cycling, swimming, dancing, yoga, stretching or gardening are excellent forms of exercise. Preferably, exercise out of doors. Don't push any exercise to exhaustion.

### Medications

When beginning your supplement program, it is important that you do not stop taking any prescribed medications. However, as your metabolism improves, some medications may gradually be reduced. It is our recommendation to discuss this with your doctor or health-care professional before making any changes.

### How to Follow the Supplement Program

- The supplement program recommendations are based upon the results of your hair tissue mineral analysis. For optimal results, it is best to follow the program exactly as outlined. Do not combine the A.M., Noon and P.M. dosages.
- Supplements should be taken just prior to, during, or immediately after meals.
- If for any reason it is necessary to reduce the number of tablets, take the program twice, or even once per day, instead of three times per day.
- You may take extra dietary aids if needed to combat gas or bloating. Start with one additional tablet per meal and increase tablet count as necessary to help alleviate bloating. Consult your health care professional if gas or bloating continues.
- Supplements may be placed in zip-lock bags or in a vitamin chest to avoid having to open your supplement bottles every day.

### What to Expect on the Program

- Generally, most individuals will notice some degree of change within a few weeks of beginning the program. However, everyone is different and some respond faster than others.
- The program is designed to restore your body's energy system. For this reason many people will feel an increase in their energy levels. If this occurs, do not immediately increase your workload and obligations. It is preferable to conserve the newly found energy, like putting money away in the bank. Otherwise, you may slow your progress considerably.
- It is possible you may observe increased fatigue for a while. This is referred to as retracing and is discussed in the following section.
- Conditions will be addressed in their own order, not necessarily in a sequence which you may think is most important. For this reason, you may notice improvement in certain areas first, while others require more time for correction.

### Healing and Retracing

Healing reactions are symptoms that accompany changes in body chemistry as deep healing occurs. (11,17,24,27,51,52) Retracing is the process whereby the body goes back and revisits chronic conditions in order to heal them completely. These may include sites of infection or injuries. An inflammatory process may possibly occur for a few days or less.

Most people experience a half dozen or more low-grade chronic infections of which they are unaware. These may flare up or become painful as the healing process proceeds. Common sites are the eyes, ears, throat, sinuses, bladder and intestines. These types of symptoms will usually pass within a few days with supportive measures such as additional rest and sleep.

Reactions may also be due to the elimination of toxic metals. When an elimination occurs, toxic metals are first moved from storage tissues into the blood stream. They are then sent to the liver, kidneys, bowel and skin for removal from the body. During the time the toxic metals are present in the blood, one may experience symptoms such as a headache, fatigue, nausea, diarrhea, constipation or stomach pain.

These reactions are normal and part of the deep healing of the body. They usually pass within a day or two. It is best to temporarily stop your nutritional supplement program and rest more during these reactions.

### **Why Minerals May be Recommended Even if the Level is High**

Research has shown that replacement therapy, recommending those minerals that are deficient on the hair tissue mineral analysis, is often not an effective method of balancing body chemistry.

Instead, your supplement program takes into account the complex relationships between minerals and between minerals and vitamins. Therefore, it is common that a mineral that is low will not be recommended and that a mineral whose level is high will be recommended. This method is essential to the success of the program.

### **Retesting**

Retests are recommended in approximately three to four month intervals. Retesting is essential because as your body chemistry changes the diet and supplement program should be adjusted to meet your current needs. Otherwise, the program will no longer properly balance your body chemistry and your progress will cease. It is best not to remain on a supplement program more than six months without a retest.

## Joe Sample

### RECOMMENDED SUPPLEMENT PROGRAM

#### METABOLIC PAK

Megapan

A.M.	NOON	P.M.
1	1	1

#### GLANDULARS

Endo-Dren  
Thyro Complex

1	1	1
1	1	1

#### CHELATED MINERALS

Paramin  
Limcomin  
Endo-Pan

1	1	1
1	1	1
1	0	1



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## Joe Sample

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The following paragraphs are explanations as to why your supplements have been recommended.

**Megapan** is a specific multiple vitamin-mineral product designed to enhance one's rate of metabolism, or oxidation rate. The correction of the metabolic rate requires a combination of nutritional factors. Megapan stresses those nutrients which correlate well with those effecting one's metabolic rate.

**Endo-Dren** contains bovine adrenal nucleoprotein together with vital synergistic nutrients to aid in restoring normal adrenal response. Glandular products contain polypeptides, enzymes and nucleoproteins which have been shown to enhance glandular function. This product is recommended for the slow oxidizer and for certain mixed oxidation types.

**Thyro Complex** is a multiple glandular product designed to support thyroid glandular activity. Thyro Complex is hormone-free and contains low temperature freeze-dried glandular material.

**Paramin** is formulated to provide the necessary balance of calcium and magnesium. Paramin provides these essential elements in a very well absorbed form including calcium and magnesium citrate and chelate. This product also contains the supportive nutrient boron to further enhance the absorption and utilization of these essential minerals.

**Limcomin** is a multi-nutrient formula specifically designed to enhance the immune system response. Limcomin contains synergistic nutrients that are of particular importance for the immune system. Limcomin is especially useful for all types of infections, both bacterial and viral. It is also excellent for symptoms of low resistance and susceptibility to infections.

**Endo-Pan** is a specifically formulated product which contains zinc, pantothenic acid and cysteine. "Zinc is critical as an activator and constituent of many enzymes". Pantothenic acid "serves as part of coenzyme A, which is at the center of energy metabolism...its chief importance stems from it's relationship to energy production (and) stress resistance..." - Kutsky The formula is designed to support adrenal gland function and in particular to enhance coenzyme-A activity which requires pantothenic acid, L-cysteine and zinc.

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**Joe Sample**

**PRESENTING SYMPTOMS**

Allergies  
Craving Sweets  
Depression  
Diarrhea  
Dizziness

Headaches  
Indigestion  
Muscle Cramps  
Negative Feelings  
Sinus Problems

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Lab # 60328

May 21, 2015

## GLOSSARY OF TERMS

The following glossary of terms are important to the comprehension of this interpretation. Please take the time to review these items and refer back to this list as often as needed.

- **Adaptation** - Adaptations are the way the body alters itself, changing mineral and vitamin levels, body temperature, blood sugar levels, etc., to survive in the best way possible, given the circumstances. In mineral balancing nutrition programs, foods, vitamins and minerals are used to remove the need for adaptations. Sometimes, nutrients are also used to force the body to adapt in ways that will promote health, using nutrition to push the body in such a way that it moves back toward normal functioning.
- **Bio-Unavailability** - This is a particular type of mineral retention or non-utilization, due to lack of a releasing factor. Bio-unavailable minerals are generally elevated, unless the mineral is locked up in tissues other than hair. In this case, the level may be very low.
- **Compensation Principle** - The minerals on the chart compensate for and adapt to one another in order to maintain critical levels and ratios.
- **Dual Concept of Energy** - There are two aspects to the body's biochemical energy system, 1) the rate of energy production or oxidation rate and 2) the energy pathway or the steps involved in energy production. Both the rate and the functioning of all steps must be optimized to obtain maximum energy production.
- **External Stress** - Factors arising from outside our bodies, which affect our health, are called external stressors. They may include physical factors (heat, cold or noise), social pressures, financial or job stress, microorganisms such as bacteria, etc.
- **Internal Stress** - Internal stressors are those factors, which originate from inside the body, which cause stress. Nutritional imbalances can be the result of stress, but is also a cause of internal stress. This is hidden stress, which can cause both physical and emotional problems.
- **Metabolism** - Metabolism is the total of the chemical reactions taking place in the body. Metabolism is divided into two parts, anabolism and catabolism. Anabolism refers to those reactions which build up body tissues, while catabolism refers to reactions and processes which tear down body tissues.
- **Mineral Displacement** - One mineral can displace or replace another. Displacement causes an elevated reading of the mineral displaced.
- **Mineral Excretion** - A physiological effect of elimination of an unneeded mineral, that had been retained. Excretion elevates the mineral reading.
- **Mineral Loss** - A pathological loss of minerals through the hair can occur due to lack of a retaining factor. A mineral loss elevates the reading.

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## Joe Sample

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- **Mineral Levels** - Refers to actual mineral levels reported on the graph.
- **Mineral Ratios** - A relationship consisting of one mineral level divided by a second mineral level.
- **Mineral Patterns** - A group of levels or ratios or some combination of the two. Slow and fast oxidation, for example, are mineral patterns defined by several ratios.
- **Minerals-Antagonistic** - Minerals which are inversely related. When the level of one mineral goes up, the other mineral level goes down. Minerals may be both synergistic and antagonistic under different conditions.
- **Minerals-Synergistic** - Minerals which are directly related. When the level of one mineral goes up, the level of the other mineral goes up also. Minerals may be both synergistic and antagonistic under different conditions.
- **Oxidation Rate** - The oxidation rate is the rate at which food is burned in the body. The oxidation rate is closely related to the metabolic rate, a term referring to the general rate of chemical reaction or metabolism in the body.

*Fast Oxidation* - The condition in which there is too rapid a release of energy in the biochemical pathway.

*Slow Oxidation* - Slower than normal release of energy in the biochemical pathway.

*Mixed Oxidation* - A transition or unstable state in which one of the glands, thyroid or adrenal, is overactive and the other underactive, causing an unstable release of energy.

- **Retracing** - The concept that as old mineral patterns are passed through on the way back to health, previous symptoms may return for a period of time.
- **System Principle** - The hair analysis graph must be viewed as a system - that is, all at once, for proper understanding. Trying to understand one reading without considering all the other readings, will only lead to confusion and misinterpretation.
- **Stages of Stress** - Dr. Hans Selye discovered that one's body passes through several well-defined stages as they come under more and more stress. He called these stages alarm, resistance and exhaustion.
- **Time Factor** - As ratios remain uncorrected over time, compensations and adaptations occur on many different levels. Time is required for correction, because these compensations and adaptations must be reversed, usually in reverse order called, retracing.
- **Toxic Metals** - Lead, mercury, cadmium, arsenic, aluminum and nickel. These may be found in the body, but have no known necessary function and can cause disease.
- **Toxic Metal Elimination** - An important goal and occurrence is the removal of toxic metals. Sometimes temporary symptoms may occur such as, a metallic taste, headache or skin rash as toxic metals are removed.

## EDUCATIONAL MATERIAL TO FOLLOW

## **BASIC RATIOS AND THEIR MEANING**

### **INTRODUCTION**

Balance in all phases of life is critically important to maintain health and this principle applies to mineral levels in hair analyses.

What is a mineral ratio? A pure number consisting of one mineral level divided by a second mineral level. Mineral ratios are often more important in determining nutritional deficiencies and excesses than mineral levels alone, although both are important and should be considered together. The understanding of mineral ratios is extremely exciting and much more revealing than analyzing mineral levels alone.

### **THE IMPORTANCE OF RATIOS**

- *Ratios* are often more important than levels.
- Ratios represent *homeostatic balances*.
- Ratios are indicative of disease *trends*. These are not diagnostic but are research *associations*.
- Ratios are frequently *predictive* of future metabolic dysfunctions or hidden metabolic dysfunctions.
- Ratios can be used to *chart progress*. However, one must consider *all* the important ratios, as well as mineral levels, symptoms and signs.
- The following five (5) ratios are the most important for evaluation purposes:

### **THE BASIC MINERAL RATIOS**

#### ***Calcium/Magnesium (Ca/Mg) Ratio:***

- Normal ratio is 6.67:1
- Referred to as the blood-sugar ratio
- Calcium is required for the release of insulin from the pancreas  
Magnesium inhibits insulin secretion
- Magnesium is necessary to keep calcium in solution
- A very high (greater than 16.0) or very low calcium/-magnesium ratio (less than 2.0) is often associated with mental or emotional disturbances.

#### ***Sodium/Potassium (Na/K) Ratio:***

- Normal ratio is 2.5:1
- Referred to as the life-death ratio because it is so critical
- Related to the sodium pump mechanism, and the

electrical potential of cells which is regulated by sodium and potassium levels

- Sodium is normally extracellular, while potassium is normally intracellular. If the ratio of these minerals is unbalanced, it indicates important physiological malfunctions within the cells.
- The sodium/potassium ratio is intimately linked to adrenal gland function, and the balance between aldosterone (mineralocorticoid) and cortisone (glucocorticoid) secretion.
- A low sodium/potassium ratio, greater than 1:1 and less than 2.5:1 is indicative of a tendency towards kidney and liver dysfunction, allergies, arthritis, adrenal exhaustion, digestive problems, deficiency of hydrochloric acid.
- A sodium/potassium ratio less than 1:1 is indicative of a tendency towards heart problems, arthritis, kidney and liver disorders.
- Severe elevation of the sodium/potassium ratio is indicative of inflammation and adrenal imbalance.
- A high ratio can also be associated with asthma, allergies, kidney and liver problems.

#### ***Calcium/Potassium (Ca/K) Ratio:***

- Normal ratio is 4:1
- Called the thyroid ratio because calcium and potassium play a vital role in regulating thyroid activity.
- Does not always correlate with blood thyroid tests because hair analysis is a *tissue* test. Often blood tests will be normal but hair analysis will indicate an impaired thyroid function. Sometimes symptoms of hypothyroidism may be evident, but the hair test will show a hyperactive thyroid ratio. For nutritional correction, *it is prudent to follow the hair analysis indication*.
- The thyroid gland is one of the major glands which regulate metabolic rate in the body. A hyperactive thyroid is associated with fast metabolism.
- When the thyroid (and adrenal) ratios are not normal, the efficiency of energy production in the body decreases. It is like an engine that is turning too slow

or too fast - power output declines.

- *Symptoms of Reduced Thyroid Activity Include:* Cold hands and feet - tendency to feel cold, dry skin and dry hair, fatigue, lack of sweating, tendency to gain weight, tendency towards constipation.
- *Symptoms of Overactive Thyroid Activity Include:* Excessive sweating, hyperactivity, irritability, nervousness, occasional tendency towards frequent bowel movements or diarrhea during times of stress, oily hair and skin.

### **Sodium/Magnesium (Na/Mg) Ratio:**

- Normal ratio is 4.17:1
- Referred to as the adrenal ratio because sodium levels are directly associated with adrenal gland function. Aldosterone, a mineral corticoid adrenal hormone, regulates retention of sodium in the body. In general, the higher the sodium level, the higher the aldosterone level.
- The sodium/magnesium ratio is also a measure of energy output, because the adrenal glands are a major regulator (along with the thyroid gland) of the rate of metabolism.
- The sodium/magnesium ratio is a tissue reading and will often not match blood tests for adrenal hormones. Usually the blood tests will be normal, but the tissue mineral test will show abnormal adrenal function. Symptoms, however, usually correlate well with the hair analysis.
- *Symptoms often associated with Underactive Adrenal Glands Include:* Allergies, depression, fatigue or diminished stamina, hypoglycemia, poor digestion - diminished ability to tolerate fats and meat protein, weight fluctuations.
- *Symptoms often associated with Overactive Adrenal Glands Include:* Aggressiveness, impulsiveness, diabetes, hypertension, increased stamina and drive, tendency to inflammation and inflammatory reactions, type A personality.

### **Zinc/Copper (Zn/Cu) Ratio:**

- Normal ratio is 8:1

- Using the zinc/copper ratio is a much more effective method of evaluating zinc and copper readings than considering either copper or zinc levels alone.
- A high zinc/copper ratio is indicative of a zinc dominance.
- *Symptoms often associated with a high zinc/copper ratio may include:* Atherosclerosis, female problems, hypercholesterolemia, skin problems.
- A low zinc/copper ratio is indicative of a copper dominance and a possible copper toxicity.
- *Symptoms often associated with a low zinc/copper ratio may include:* Allergies, asthma, headaches, immune deficiency, female problems, infections, insomnia, liver problems, skin problems (eczema, acne, hives, psoriasis, skin rashes), psychological problems, behavior problems, emotional instability.
- Severe copper toxicity - excessive breakdown, emotional instability, zinc deficiency problems such as impotence, slow healing, loss of taste, smell, appetite, and hair loss.

### **OXIDATION TYPES**

#### ***Definition of Fast Oxidation:***

Calcium/Potassium Ratio Less Than 4:1

**and**

Sodium/Magnesium Ratio Greater Than 4.17:1

#### ***Definition of Slow Oxidation:***

Calcium/Potassium Ratio Greater Than 4:1

**and**

Sodium/Magnesium Ratio Less Than 4.17:1

#### ***Definition of Mixed Oxidation:***

Calcium/Potassium Ratio Greater Than 4:1

**and**

Sodium/Magnesium Ratio Greater Than 4.17:1

**or**

Calcium/Potassium Ratio Less Than 4:1

**and**

Sodium/Magnesium Ratio Less Than 4.17:1

For more information on this topic go to [www.arltma.com](http://www.arltma.com) - Articles

## OXIDATION TYPES

Metabolic typing is a central concept in hair analysis interpretation and the science of nutritional balancing. The term 'oxidation types' originated with Dr. George Watson, PhD, a researcher at UCLA. He wrote a fascinating book entitled, *Nutrition and Your Mind*, and a second book entitled, *Personality Strength and Psychochemical Energy*. Dr. Watson discovered two metabolic types, first by using odor tests and later by using blood tests. He found that the blood pH of fast oxidizers was slightly more acidic than that of slow oxidizers.

He discovered that certain foods and nutrients benefited each metabolic type. He was able to correct the oxidation rate using diet and supplementary nutrients. This caused dramatic improvements in both his client's physical and emotional symptoms.

Dr. Paul C. Eck refined Dr. Watson's oxidation concepts. An important advance was to relate it to homeostatic states as defined by the stress theory of disease. *Fast oxidation correlates with an alarm stage of stress. Slow oxidation correlates with a resistance or exhaustion stage of stress.* Essentially, fast and slow oxidation are ways that the body responds to stress. The stress may be from within, such as nutrient deficiencies or fatigue. Stress may also arise from a multitude of external sources. Dr. Eck also began to use hair mineral analysis for assessing oxidation types. After considerable experimentation, he settled on two mineral ratios for this determination.

### DEFINITIONS OF THE OXIDATION TYPE AND THE OXIDATION RATE

Fast oxidation is defined as a hair calcium/-potassium ratio less than 4 and a hair sodium/-magnesium ratio greater than 4.17. The lower the calcium/potassium ratio or the higher the sodium/-magnesium ratio, the faster the oxidation rate.

Slow oxidation is defined on a hair mineral analysis as a calcium/potassium ratio greater than 4 and a sodium/magnesium ratio less than 4.17. The higher the calcium/potassium ratio or the lower the sodium/-

magnesium ratio, the slower the oxidation rate.

It is important to note that many factors can influence the hair mineral levels and ratios. These include the presence of excessive toxic metals, nutritional deficiencies, infections, illnesses or stress from any source. For this reason, the first few hair analyses may give only a superficial picture of the condition of body chemistry. After several months to more than a year of nutritional balancing, the hair mineral patterns often change dramatically.

### FAST OXIDATION

Fast oxidation is characterized by excessive activity of the thyroid and adrenal glands. More adrenal activity and thus a higher level of aldosterone raises the hair or soft tissue sodium and potassium levels. This also results in lower tissue levels of calcium and magnesium due to increased solubility of calcium and magnesium. Blood mineral levels do not usually correspond to the levels of these minerals in the hair.

*On a hair mineral analysis, the pattern of fast oxidation is one of lowered calcium and magnesium levels, along with elevated levels of sodium and potassium.* Fast oxidizers also have significant *sympathetic nervous system tone*. This in part accounts for their increased adrenal and thyroid glandular activity, as sympathetic nervous activity stimulates the activity of these glands.

### SLOW OXIDATION

In slow oxidation, the activity of the adrenal and thyroid glands decreases. The glands themselves and at times the sympathetic nervous system are both basically depleted of nutrients and do not function well. In part for this reason, slow oxidation is related to a *parasympathetic state of body chemistry* with less fight-or-flight activity. In almost all cases, the sympathetic nervous system is exhausted and the person moves into a parasympathetic state by default.

Slow oxidation, especially when the rate is very slow, is an *exhaustion stage of stress*, according to Dr.



Selye's stress theory of disease.

Tissue sodium correlates well with the activity of aldosterone, an adrenal hormone. *Thus, on a hair mineral analysis, slow oxidizers have low levels of sodium and potassium. Calcium and magnesium rise in the hair as the tissue sodium level decreases.* This occurs, in part, due to reduced solubility of calcium that results when the tissue sodium level is low.

### MIXED OXIDATION

Mixed oxidation is said to be present when the calcium/potassium ratio is greater than 4 and the sodium/magnesium ratio is greater than 4.17. Alternatively, the calcium/potassium ratio may be less than 4 and the sodium/magnesium ratio less than 4.17.

We use the terms *fast-mixed* oxidation when the key ratios tend more toward fast oxidation. When they tend more toward slow oxidation, we call it *slow-mixed oxidation*. Mixed oxidation is a temporary state that will change to fast or slow oxidation when one follows a nutritional balancing program.

### SYMPTOMS OF FAST OXIDATION

*True fast oxidizers* tend to be anxious, irritable and aggressive if their oxidation rate is very fast. Their blood sugar and blood pressure tend to be on the high side of normal. They are often warm and sweat easily. They usually have oily skin, and a tendency for frequent or loose bowel movements. They may gain weight in the area of the abdomen due to high levels of cortisol and cortisone.

Most people whose hair analysis indicates fast oxidation, however, are not true fast oxidizers.

Instead, they are what we call *tired or temporary fast oxidizers*, or *slow oxidizers under stress*. Hair analysis indicators for this condition are:

- A sodium/potassium ratio less than about 2, OR at times when the ratio is greater than about 10.
- A hair calcium level greater than about 40 mg%, OR a magnesium level greater than about 6 mg%.
- A four-low-electrolyte pattern with calcium less than about 40 mg%, magnesium less than about 6 mg%, sodium less than about 25 mg% and potassium less than about 10 mg%.

### SYMPTOMS OF SLOW AND MIXED OXIDATION

*Slow oxidizers* often suffer from fatigue, sweet cravings and low blood sugar. As their oxidation rate slows further, they often become apathetic and depressed. Their blood pressure and blood sugar may be low unless arteriosclerosis or diabetes have set in. Their skin and hair are often dry and their hair may become brittle or thin. Many experience constipation and other symptoms associated with reduced adrenal and thyroid glandular activity. Slow oxidizers may gain weight on the hips and the legs due to their metabolic imbalances.

*Mixed oxidizers* often display a mixture of symptoms of both fast and slow oxidation. One may need to wait until the mixed oxidation pattern resolves into slow or fast oxidation to gain a clear picture of underlying metabolic patterns.

For more information on this topic go to [www.arltma.com](http://www.arltma.com) - Newsletters

## Joe Sample

### FOODS THAT SHOULD BE ELIMINATED, OR AVOIDED WHEN POSSIBLE READ ALL LABELS ON PROCESSED FOODS

Alcohol	Deli Cole Slaw	Karo Syrup	Processed Meats
Applesauce	Dextrose	Ketchup	Relish
Apple butter	Eggnog	Maple Syrup	Salad Dressings
Cakes/Cookies	Fruits/Fruit Juices	Meat Fillers	Soda Pop
Candy/Chewing Gum	Glucose	Milk	Sorbitol
Canned Foods w/Sugar	Honey	Molasses	Soup (containing sugar)
Chocolate	Honey Roasted Peanuts	Pastries	Steak Sauce
Cool Whip	Ice Cream/Sherbet	Peanut Butter	Sucrose
Corn Sweetener	Jams and Jellies	(Commercial)	Sugared Cereals
Cough Lozenges/Syrup	Jello	Pop Tarts	Sweet Pickles
Cranberry Sauce	Juice Concentrate	Potato Salad	Sweetened Yogurt

### ADDITIONAL FOOD INFORMATION WHICH MAY BE HELPFUL CHOOSE ORGANIC FOODS WHEN POSSIBLE

#### ACCEPTABLE COMPLEX CARBOHYDRATES

Barley  
Buckwheat  
Oats  
Organic Blue or Yellow Corn/  
(Including chips and corn tortillas)  
Quinoa  
Rice (Preferably organic brown rice)  
Rye

#### ACCEPTABLE PROTEIN TYPE FOODS

Beans  
Brewer's Yeast  
Eggs  
Fish  
Natural Peanut Butter  
Nuts and Seeds  
Poultry  
Protein Drinks [Low Sugar]  
Red Meats  
Wheat Germ

#### ACCEPTABLE FATS AND OILS

Avocado  
Butter  
Cream  
Meats

#### COMPLEX CARBOHYDRATES TO BE AVOIDED

Corn Starch  
Flour Tortillas  
Grits  
Most White Rice, Except Basmati Rice  
White or Wheat Flour

#### PROTEIN FOODS TO BE AVOIDED

Processed Cheese  
Processed Meats  
Raw Wheat Germ is usually rancid

#### FATS AND OILS TO BE AVOIDED

Commercial Peanut Butter  
Cool-Whip  
Margarine  
Redi-Whip

#### ACCEPTABLE FATS AND OILS - CONTINUED

Nuts & Seeds and Nut & Seed Butters  
Olive Oil  
Sour Cream  
Unrefined Vegetable Oil

## **CALCIUM/MAGNESIUM RATIO**

### **NORMAL AND ABNORMAL RATIOS**

The ideal Ca/Mg ratio in an unwashed sample of hair is about 6.67:1. Generally, a Ca/Mg ratio lower than 4.5 or greater than 8.5 is indicative of a sensitivity to sugars and simple carbohydrates. Between 10:1 and 12:1, or 3:1 and 3.3:1 are considered hypoglycemic ranges. Over 12:1 and less than 3:1 are considered a severe sugar and simple carbohydrate sensitivity range. Washing the hair at the laboratory can skew the Ca/Mg ratio and render it less reliable.

Ratios greater than 10:1 or less than 3:1 also indicate a tendency for calcium precipitation in the tissues. This can cause bone spurs, arthritic changes, arterial calcification and calcium stone formation in the kidneys or gall bladder. Magnesium is required to keep calcium in solution. When the ratio is imbalanced, it may reflect a relative magnesium deficiency.

Highly imbalanced ratios - above 12:1 and less than 3:1 - often indicate emotional difficulties.

### **BUT I DON'T EAT CARBOHYDRATES**

An imbalanced Ca/Mg ratio may often indicate excessive carbohydrates in the diet. All foods contain

### **STRESS**

Stress of any kind can affect the Ca/Mg ratio. This is most likely due to its affect on the adrenal glands and glucose metabolism. Stress can increase blood sugar through the action of cortisol, leading to reduced sugar tolerance. Nutritional depletion from stress, and sustained excessive cortisol and insulin secretion can cause increased insulin resistance.

Cortisol release increases osteoblastic activity that may lead to a higher tissue calcium level as calcium is released from the bones. Excessive calcium channel activity due to stress can cause a catabolic state, with increased cell death and release of magnesium from the cells.

An imbalanced Ca/Mg ratio may also be secondary to an imbalanced Na/K ratio. The latter is a blood

carbohydrates. However, carbohydrate-rich foods are grains, pasta, bread, potatoes, beans, carrots, peas, corn, fruit, sweets and sugars such as fructose, dextrose, malt sweeteners, honey and maple syrup. At times, patients tell us they are not eating any of these foods, yet their Ca/Mg ratio is unbalanced. There are several explanations.

Many people are not aware or truthful about the amount of carbohydrates they consume. Carbohydrates may be hidden in many foods, especially prepared and packaged foods. Many, many items have added sugar, cornstarch, barley malt, flour, fructose and other starches or sugars. Also, remember the starchy vegetables - potatoes, carrots, beets, turnips, rutabaga, winter squash, corn, beans and peas. Although they are superior to eating sugar because they contain more fiber, vitamins and minerals, one can still overeat on them. Fruits, fruit juices, wine, beer, mixed drinks and soft drinks may be very high in carbohydrates.

If you have thoroughly ruled out excessive dietary carbohydrates, consider these other causes for an unbalanced Ca/Mg ratio.

sugar ratio related less to diet and more to the effects of stress on energy production.

The Ca/Mg and Na/K ratios may correlate because of a direct relationship between calcium and sodium, both extracellular elements and between magnesium and potassium, both intracellular elements.

Also, sodium and magnesium tend to be antagonistic, as do calcium and potassium. That is, one rises when the other falls. Dr. Louis Kervan found that sodium-magnesium is a common transmutation, perhaps affected by adrenal gland activity. Dr. Paul Eck found the Ca/K and Na/Mg ratios are better indicators of glandular activity than simply mineral levels.

When both Ca/Mg and Na/K ratios are low, it is referred to as a double inversion. It can reflect a more

severe Na/K inversion, associated not only with carbohydrate intolerance, but also immune system weakness, protein catabolism, chronic emotional stress and adrenal exhaustion.

Similarly, if the Ca/Mg and the Na/K ratios are elevated, the high Ca/Mg ratio may reflect a more severely elevated Na/K pattern, which is associated with acute stress, inflammation and related symptoms.

### **EMOTIONAL STRESS**

Emotional stress, even positive stress, can affect the Ca/Mg ratio. Perhaps it is because stress affects carbohydrate tolerance. Other factors may also contribute. For example, the "*calcium shell*" phenomenon is related to an excessively elevated calcium level. This has a numbing and protective effect in the face of stress. Usually the magnesium level also rises, but in some cases the Ca/Mg ratio may also be elevated.

Copper toxicity, often related to stress, also initially affects the calcium level. Once again, the Ca/Mg ratio is usually maintained, but may not be under some circumstances. Addressing emotional factors may be essential for balancing the Ca/Mg ratio.

### **ZINC, TAURINE AND VITAMIN B<sub>6</sub>**

Deficiencies of zinc, taurine and vitamin B6 affect magnesium levels. These nutrients are synergistic with magnesium. High-carbohydrate diets deplete zinc and vitamin B6 and often lack taurine, which is found only in meats.

Deficiencies of these nutrients may cause a magnesium loss or biounavailability. Recall that a high level of any nutrient element on a hair analysis often indicates biounavailability, or loss of the element into the hair tissue.

Most diets are also low in magnesium. This is made worse by drinking a lot of milk, taking calcium

supplements that do not contain magnesium, or eating refined-food diets. While calcium deficiency gets lots of press, magnesium deficiency also occurs commonly.

### **TOXIC METALS AND CONTAMINATION**

Lead and other toxic metals in the body can skew a Ca/Mg ratio. Lead displaces calcium from the bones. Cadmium can also displace calcium. Toxic metals may or may not be revealed on the hair analysis, as they may be sequestered deep in body tissues. If not revealed on the test, they will often show up on future tests as body chemistry improves provided the patient follows a scientific program designed to balance body chemistry.

### **HANDLING IMBALANCED CA/MG RATIOS**

Begin by reducing dietary carbohydrates, improving digestion and correcting the diet in accordance with the oxidation type. Supplementing with sufficient zinc, magnesium, vitamin B6 and taurine are helpful, along with supplements indicated by other hair analysis patterns.

Reducing stress may be very important. Severe stress can inhibit or even override any dietary or supplement program! Any time the Ca/Mg ratio is very imbalanced - greater than 15:1 or less than 2.5:1 - emotional stress is likely and important to address.

If a double inversion is present (low Ca/Mg and low Na/K), or adrenal exhaustion is suspected, the first priority for correction is the Na/K ratio. As this improves, often the Ca/Mg ratio will improve as well. The two ratios may alternate in their improvement over a period of months.

If toxic metals are affecting the ratio, the diet and supplement program can help mobilize these from storage, at which time the ratio will often improve.

For more information on this topic go to [www.arltma.com](http://www.arltma.com) - Articles

## LOW SODIUM/POTASSIUM RATIO

An increasingly common and very important hair mineral pattern is the low sodium/potassium ratio, also called a *sodium/potassium inversion*. An inversion is indicated whenever the sodium/potassium ratio is less than 2.5:1 in an unwashed hair sample. As the ratio becomes even lower, the inversion is considered more extreme. A lower ratio increases the likelihood of experiencing symptoms related to this critical mineral imbalance.

### THE MEANING OF AN INVERSION

Research at the Eck Institute indicates that an inversion can be understood in a number of ways. The different ways of understanding an inversion overlap and relate to one another. Let us discuss them one by one.

**Adrenal Burnout.** The sodium/potassium ratio is called 'the vitality Ratio'. A low ratio is indicative of an exhaustion stage of stress. A *high* sodium/potassium ratio is an alarm or early stage of stress. As the ratio declines, the body moves into an exhaustion stage of stress.

The sodium level is controlled by aldosterone. As adrenal activity declines, sodium falls in relation to potassium. Potassium is more closely tied to the level of the glucocorticoid hormones (cortisone and cortisol). Hans Selye, M.D. noted that cortisol levels rise in the exhaustion stage of stress.

**A Diabetic Trend.** An inversion is a clear indicator of glucose intolerance. The body is unable to adequately burn glucose in the Krebs and glycolysis cycles adequately. This contributes to fatigue, cravings for sweets and many other symptoms.

**Protein Catabolism.** When the body cannot burn sugars properly, it begins to break down tissue proteins to use for energy. Excessive tissue breakdown can contribute to many health conditions. For

example, if tissue breakdown occurs in the joints, arthritis may result. If tissue breakdown occurs in the stomach lining, an ulcer may result.

**Frustration.** An inversion is closely associated with a personality that is deep in frustration, and often resentful and hostile. The person is still in a fighting phase, but is not successful - like beating one's head against the wall. This is sometimes called a 'double-bind' situation.

**Chronic Stress.** We differentiate between acute and chronic stress. *Acute* stress is often indicated by a *high* sodium/potassium ratio, whereas *chronic* stress is indicated by a *low* sodium/potassium ratio. Chronic means the stress, whether from an internal or external source, has been going on for some time and the body is not successfully overcoming the stress.

Whereas acute stress is related to inflammation and acute conditions, chronic stress is associated with breakdown of tissue proteins and with chronic illness.

**Potassium Loss From The Cells.** Chart-wise, the potassium level is high relative to sodium in an inversion, in part, because potassium is being lost from the cells and is released as cells die. For this reason, at times, individuals with inversions have symptoms of potassium deficiency. Certain nutritional products, such as the aspartates, may be recommended to supply potassium in a readily absorbable form to these individuals.

**Hidden Copper Toxicity.** Hidden copper imbalance is indicated by an inversion because proper copper balance requires strong adrenal gland activity. As the adrenal glands weaken, the body is unable to bind copper properly. Copper then begins to accumulate in various body tissues.

**An Impaired Immune System.** A sodium/potassium inversion is the prime indicator of impaired immune

system activity. Commonly, a chronic sinus infection or other chronic infections are present. Tissue catabolism and hidden copper imbalance may contribute to the impairment of the immune system when the sodium/potassium ratio is low.

### **SYMPTOMS ASSOCIATED WITH SODIUM/- POTASSIUM INVERSIONS**

Mild inversions (when the Na/K ratio is 2-2.5:1) may not be associated with any obvious symptoms. As the ratio drops lower than 2:1, however, feelings of fatigue and frustration are much more common. Sweet cravings and other glucose tolerance abnormalities are also common. The immune system may be impaired

so that one is prone to colds or other infections.

As the sodium/potassium ratio becomes chronically less than 1.5:1, the likelihood increases for more serious conditions. Ulcers, digestive difficulties, cardiovascular conditions, cardiomyopathy, sugar and simple carbohydrate sensitivity, arthritis, allergies, asthma and malignancies become more common.

It is rare for an adult to have a sodium/potassium ratio less than 0.5:1. Children, on the other hand, often reveal sodium/potassium ratios less than 1:1, with no apparent harm. These children are, however, under chronic stress and are prone to infections, allergies and behavior and learning problems.

For more information on this topic go to [www.arltma.com](http://www.arltma.com) - Articles

## **ADRENAL INSUFFICIENCY**

### **WHAT IS ADRENAL INSUFFICIENCY?**

Adrenal insufficiency refers to the inability of the adrenal glands to produce a normal quantity of hormones. It may also be defined as a reduced ability to cope with stress. It is one of the most common imbalances in our population today.

Adrenal insufficiency is not to be confused with Addison's disease. Addison's disease is more or less a total adrenal gland shutdown, or adrenal burnout. Adrenal burnout, low sodium/potassium ratio, is a more severe mineral imbalance which affects the energy-producing mechanisms of the body.

### **ABOUT THE ADRENAL GLANDS**

The adrenal glands are often referred to as the stress glands or the fight-or-flight glands. The fight-or-flight response is mediated by the adrenal medulla. The fight-or-flight response is the way our bodies respond to stress.

The stress response is caused by the action of the adrenal hormones. Symptoms of adrenal insufficiency can be directly traced to a reduced secretion of these hormones when under stress. Adrenal hormones are divided into two groups, those produced in the adrenal medulla and those produced in the adrenal cortex.

Hormones produced in the medulla are epinephrine and norepinephrine. The hormones produced by the adrenal cortex are aldosterone, cortisol and cortisone. The cortical hormones have a slower, more prolonged action.

*Aldosterone* is called a mineralocorticoid hormone. Its primary function is to increase sodium retention by the kidneys. Aldosterone levels roughly correlate with *sodium* levels on a hair mineral analysis. Aldosterone is a pro-inflammatory hormone required to initiate a healing reaction.

*Cortisol and cortisone* are referred to as glucocorticoid hormones because they cause conversion of amino acids and glycogen to glucose. The corticosteroids are anti-inflammatory and provide a mild sense of euphoria. Cortisol levels roughly correspond to the *potassium*

level on a hair mineral analysis.

A balance between aldosterone and cortisol, sodium and potassium, is necessary to maintain one's health. This balance is associated with the ratio of sodium to potassium on a hair analysis.

### **CAUSES OF ADRENAL INSUFFICIENCY**

**Genetics.** Genetics can affect the adrenal glands. Also, genetic defects can be a cause of physical and emotional stress that can weaken the adrenal glands.

**Congenital Weakness.** Congenital means present at birth. However, it is not related to the genes. It is caused by nutritional deficiencies of the mother that are passed on to the child. It may also be caused by toxic metals or other toxins passed on from the mother's body that interfere with the functioning of the adrenal glands. This is a very common cause of adrenal insufficiency today.

**Nutritional Imbalances.** These can begin early in childhood with inadequate diets, diet inappropriate for one's oxidation type, poor food quality, or digestive problems that prevent proper nutrition. Even natural foods today often are low in vital minerals and do not provide adequate nutrition. Pesticides, heavy metals, bacteria, solvents and other organic chemicals can all act as stressors that weaken the adrenal glands.

**Emotional or Psychological Stress.** Responding to emotional stress over and over will eventually deplete the adrenal glands. A single overwhelming shock such as death of a loved one, can also deplete the adrenal glands. Emotional stress can begin in childhood, or at any time in life. It is actually the resistance or fear of a situation that causes the stress response.

Other possible stressors include pressures from family, school, work, social pressure, financial stress and others. People who force their bodies to "run or fight" all the time by any means will tend to exhaust their adrenal glands. The 'fight-or-flight' tendency must be balanced by adequate rest and sleep.

**Stimulants.** Most stimulants whip the adrenal glands. This may cause one to feel better for a while, but the long-term effect is to weaken the adrenal glands.

Stimulants include sugar, alcohol, caffeine, theobromine in chocolate, amphetamines and other medical drugs, cocaine, heroin and others.

Other types of stimulants can include loud noise, loud music, light stimulation, excessive exercise and excessive vibration. Anger, fear and worry can actually act as stimulants as well.

Note that stimulant use can be a result, as well as a cause of adrenal insufficiency. A person who is tired, due to weak adrenal glands, may be attracted to stimulants such as drugs, loud music, or anger to feel better temporarily.

**Infections, Energetic and Structural Imbalances.** These are all internal stressors that, if left uncorrected, can eventually weaken the adrenal glands by forcing the body to mount a chronic stress response to these irritants.

**Toxic Substances.** These may include chlorine in water, polluted air, mercury from dental fillings, household chemicals, food additives, pesticide exposure, dusts, molds and pollens. These often cause allergies that can be controlled with cortisone, the adrenal hormone.

Medical therapy, particularly cortisone or prednisone therapy, weakens the adrenal glands by creating hormone imbalances.

**Mental Attitude.** One's attitude makes a great difference in determining the stress response. Worry, fear, anger and resentment tend to increase the stress response. An attitude of gratitude, and compassion for oneself and others tends to diminish the stress response. Understanding the impermanence of the body and the world we live in, emotional detachment and detachment from all form, and a single-minded desire to extend love can greatly diminish the stress response.

### **DETECTION OF ADRENAL INSUFFICIENCY**

#### **Hair Analysis**

Hair mineral analysis is an excellent assessment tool for adrenal insufficiency when the test is properly performed. It is probably more reliable and sensitive

than the blood or urine tests.

The hair must not be washed at the laboratory. This is because washing at the laboratory erratically removes sodium and potassium, critical minerals for adrenal assessment. According to the research of Dr. Paul Eck, the following are indicators of adrenal insufficiency on a hair analysis. The more of these indicators that are present, the greater the evidence of adrenal insufficiency. Also, the more extreme the values, the more suggestive of adrenal insufficiency problems.

- Sodium level less than 25 mg%
- Potassium level less than 10 mg%
- Sodium/potassium ratio less than 2.5:1
- Sodium/magnesium ratio less than 4.17:1
- Calcium/potassium ratio greater than 10:1

### **CORRECTION OF ADRENAL INSUFFICIENCY**

- ▶ The only medical treatment for adrenal insufficiency is cortisone replacement therapy. Unfortunately, this therapy is accompanied by serious side effects. In our experience, the best approach involves:
- ▶ Nutritional assessment through tissue mineral analysis.
- ▶ A wholesome diet of natural foods appropriate for one's oxidation type and digestive ability.
- ▶ Nutritional supplements to reduce stress and enhance adrenal activity. The adrenal glands especially require vitamins A, C, E, pantothenic acid, manganese and zinc. Adrenal glandular substance is also recommended to provide adrenal nucleoprotein and other specific nutritional factors to help rebuild the adrenal glands.
- ▶ Supplements to enhance overall metabolism, eliminate toxic metals and enhance absorption and digestion of food.
- ▶ Lifestyle modification to reduce harmful stressors.

In mild cases of adrenal insufficiency, correction can be made in a matter of months. In more difficult or longstanding cases, complete correction may require several years. Persistence and patience are needed for optimal results.

For more information on this topic go to [www.arltma.com](http://www.arltma.com) - Articles



## COPPER TOXICITY

### INTRODUCTION

Copper toxicity, (excess tissue copper) is one of the most commonly encountered imbalances that we find on tissue mineral tests today. Many of the most prevalent metabolic dysfunctions of our time are related in some way to a copper imbalance.

Copper toxicity is a much-overlooked cause of many important health conditions today, including fatigue, premenstrual syndrome, anorexia, depression, anxiety, migraine headaches, allergies (food and environmental allergies) and many others.

Copper directly or indirectly affects virtually every body system. Copper also interferes with adrenal and thyroid gland activity, creating another set of symptoms relating to hypothyroidism and adrenal insufficiency.

### ADRENAL GLAND EXHAUSTION

Diminished adrenal activity is perhaps the single most important physiological reason for copper problems today. The reason is that adrenal activity is required to stimulate production of ceruloplasmin, the primary copper-binding protein.

When adrenal activity is insufficient, ceruloplasmin synthesis in the liver declines. Copper that is not bound cannot be used and unbound copper begins to accumulate in various tissues and organs such as the liver, brain, heart and kidneys. However, excess copper can accumulate in almost every organ of the body.

As a result of excessive tissue storage of bio-unavailable or unbound copper, a deficiency of available copper occurs, even when dietary intake of copper is more than adequate.

### ZINC DEFICIENCY AND COPPER TOXICITY

A widespread zinc deficiency in our population is another critical cause of a copper imbalance. Zinc and copper normally exist in a delicate balance. Zinc is a primary copper antagonist. When zinc is deficient, copper tends to accumulate in various storage organs.

Zinc deficiency is extremely common today. Dr. Carl Pfeiffer has stated that the entire American population

is borderline deficient in zinc. A zinc deficiency may be due to:

- stress of any kind causing an increased excretion of zinc.
- a high sugar and carbohydrate diet which lowers tissue zinc levels.
- vegetarian diets which are lower in zinc inasmuch as a main source of zinc in the diet is derived from meat protein, particularly red meat.
- low levels of zinc in the soil resulting in lowered zinc levels in foods.
- refining of food which removes zinc.
- the fact that many children today are born deficient in zinc because their mothers are deficient.

### OTHER CONTRIBUTING CAUSES OF COPPER TOXICITY

The following factors are also major contributing factors to copper toxicity.

**Low Zinc/Copper Ratio** - The ideal zinc/copper ratio is 8:1. If an individual's zinc/copper ratio is below 4.5:1, a copper toxicity must be considered. One does not have to have a high copper level to suffer from copper-related disorders.

**Stress and Copper** - Sudden or severe stress causes immediate loss of zinc from the body, upsetting the zinc/copper ratio. Prolonged or severe stress can precipitate all the symptoms of copper toxicity, including loss of appetite, migraine headaches, emotional difficulties, skin rashes, etc.

**Congenital Copper Imbalance** - Mothers deficient in zinc, or high in copper, transmit these imbalances to their children through the placenta. Untold numbers of children today are born with a copper imbalance. Often they suffer from learning problems, developmental disability, chronic infections and other problems.

**Birth Control** - One of the side effects of the pill is that it tends to raise copper levels in the body. This is due to the close association between the hormone estrogen and copper levels. In addition, several hundred milligrams of copper a year can easily be absorbed from an intra-uterine device.

**Vitamin and Mineral Supplements** - Copper is frequently added to vitamin supplements, particularly *prenatal vitamins*. Although this is a benefit for some people, it can be harmful for many other women.

**Fungicides for Swimming Pools and Foods** - Copper sulfate is added to swimming pools and may be sprayed on fruits and vegetables to retard growth of algae and fungus.

**Vegetarianism and Other High-Copper Diets** - Many diets today are high in copper. In particular, vegetarian proteins such as soybeans, nuts, seeds, tofu, avocados and grains are high in copper content. Soybean protein is coming into wider usage, due to its low cholesterol level and lower cost. Other high-copper foods are organ meats, shellfish, wheat germ and bran, yeast, corn oil, margarine and mushrooms.

**Occupational Exposure** - Plumbers, machinists, welders, miners and others who work with copper are at risk for copper toxicity.

Environmental copper exposure can also contribute to a copper toxicity.

- ▶ Copper water pipes,
- ▶ copper tea kettles and other copper cookware can be a source of copper toxicity if used frequently over a period of time.

### CORRECTION OF A COPPER IMBALANCE

#### RESTORE ADRENAL ACTIVITY

A major goal of the nutritional supplement program is to balance the oxidation rate, which increases the body's *adaptive* energy thus allowing healing to take place. Optimizing energy levels is essential to enable the body to eliminate toxic metals, including copper. That is; internal stress on the body is removed by nutritional balancing, allowing the adrenal glands to return to more normal functioning.

#### Antagonists and Chelating Agents

Copper-lowering agents may be given, including mineral and vitamin antagonists, chelating agents and sequestrants. Specific nutrient antagonists and chelators are helpful depending on the individual's mineral balance.

These include vitamin C, molybdenum, sulfur, vitamin B6, manganese, zinc and others. These nutrients need to be given in a manner that contributes to balancing the overall body chemistry as determined by an individual hair analysis readings.

Excessive lowering of even a very high copper level can result in anxiety or other symptoms. For this reason we recommend that copper-lowering nutrients be used in conjunction with a complete nutritional program based on mineral testing.

#### Excretion

Copper is excreted mainly through the bile. Vitamin C binds or chelates copper and facilitates its removal. Zinc and manganese displace copper from the liver. Molybdenum and sulfur bind to copper and greatly facilitate its excretion.

#### COPPER REACTIONS (COPPER ELIMINATIONS)

During the correction of a copper imbalance, copper elimination frequently causes transient symptoms including headache, skin rash, free-floating anxiety, insomnia, fatigue and a flare-up of chronic conditions related to a copper imbalance.

These reactions generally last a day or two and then subside. The supplement program may be temporarily reduced if a symptom becomes particularly annoying. These symptoms are indications of a healing process and should be welcomed!

For more information on this topic go to [www.arltma.com](http://www.arltma.com) - Articles

## TOXIC METALS

We continue to receive many questions regarding toxic metals and their detection on hair mineral tests. This is a review of the principles involving toxic metals and hair testing.

### **METABOLISM OF THE TOXIC METALS**

Toxic metals are those minerals that have no known function in the human body and which are harmful. This is not an absolute definition, as any mineral may become toxic, and some toxic metals may have functions we have not yet discovered.

Toxic metals are ingested, inhaled or absorbed through the skin. However, another important source is toxic metals passed through the placenta from mother to child during gestation. These can remain in the body for a lifetime.

Once absorbed, toxic metals find their way into the bloodstream. As soon as this occurs, the body attempts to get rid of them through the normal elimination channels - the kidneys, the bile and the skin. The body also attempts to minimize toxic metal damage by sequestering or storing them away in fatty tissues, hair and other non-essential tissues.

Damage from toxic metals may occur due to their physical properties, their chemical properties or even electromagnetic interference. They often interfere with the absorption and metabolism of essential minerals and they displace vital minerals in enzyme binding sites. This can inhibit or completely disable the affected enzymes.

### **TARGET ORGANS AND PREFERRED MINERALS**

Each toxic metal has an affinity for particular organs and tissues. These are called the target organs. The target organ is different for each toxic mineral. For example, mercury migrates mainly to the kidneys and the brain, while cadmium settles in the arteries, kidneys and periosteum.

The effects of toxic metals are greatly magnified when there are simultaneous deficiencies of the vital minerals. In these cases, toxic metals can substitute for vital minerals in critical enzyme systems, acting like

*"replacement parts"*. This keeps the body functioning, but not optimally. The process is called the principle of preferred minerals. The body prefers the vital minerals, but will use toxic metals if the vital minerals are not available.

For example, zinc is required in the arteries for flexibility and strength. If zinc becomes deficient in the diet, cadmium from the diet or the environment can replace zinc in the arteries. This will allow one to continue living. However, cadmium causes more brittle arteries and is associated with hardening and sclerosis of the arteries, high blood pressure and more serious cardiovascular disease.

True correction of cardiovascular disease with this cause must involve replacing the cadmium in the arteries with the preferred mineral, zinc. This is an essential aspect of nutritional balancing science.

### **DETECTION OF TOXIC METALS**

Blood, urine and hair are commonly used to detect toxic metals. No single test can detect all toxic metals in the body. Blood tests are excellent if the metal poisoning occurred within the last few days or perhaps weeks. However, toxic metals are removed from the blood quickly. Therefore, blood tests are not helpful for detecting chronic exposure.

Some holistic physicians detect toxic metals with a 6 or a 24-hour urine sample. This is useful only if it is preceded by a dose of a chelating agent such as EDTA or DMSA for mercury. The chelator grabs many minerals in the blood, including toxic metals, and causes them to be excreted in the urine. This test will only detect heavy metals that are in the blood and perhaps those in the artery walls. It cannot detect toxic metals that are sequestered deep within organs and tissues.

Studies by the US Environmental Protection Agency and the Atomic Energy Commission confirm the value of hair analysis for detecting chronic toxic metal exposure, the most common type of exposure.

### **WHY DON'T ALL HEAVY METALS SHOW UP ON A HAIR ANALYSIS?**

Toxic metals are fixed in the protein structure of the hair tissue as the hair grows. This may reflect the total amount of toxic metals in the body, but not always. Some toxic metals accumulate in other organs and tissues.

To detect the metals in every organ would require a biopsy of every organ. For this reason, a person who was exposed to a toxic metal may not have an elevated reading of that metal on his first hair analysis. This just means the metal is not deposited in the hair tissue.

Fast oxidizers often have higher levels of toxic metals in their hair than slow oxidizers. This is not because fast oxidizers are more toxic. It is because fast oxidizers have more energy as a rule and are better able to eliminate toxic metals through the hair.

In fact, slow oxidizers, as a group, are more toxic because they have less ability to remove toxic metals, causing more accumulation of toxic metals in their bodies. As their body chemistry improves and their oxidation rate increases, many slow oxidizers begin to eliminate more metals through their liver, kidneys, skin and hair. This will often cause a temporary increase in the hair tissue readings. The toxic metal readings may fluctuate up and down as the body releases different deposits of the same toxic metal from various tissue storage sites.

Most people are so toxic, this process can go on for years. At times, one toxic metal reading may rise first and then a different metal will increase. This alternating elimination is how the body controls the process to avoid overloading the organs of elimination during detoxification.

### **HOW DO WE ASSIST TOXIC METAL ELIMINATION?**

Several methods are used to eliminate toxic metals. Prescription synthetic chelating agents include penicillamine for copper, Deferroxamine for iron and

aluminum, EDTA for many metals and DMPS or the less-toxic DMSA for mercury.

These chemicals are powerful, but have three drawbacks: First, they often remove vital minerals along with the toxic ones, causing vital mineral imbalances. Second, they remove the metals through the kidneys which can stress the kidneys. Third, the chemicals themselves may have some toxicity.

Vitamin C, sulfur-containing amino acids, foods such as cilantro and slow-cooked beans, herbs such as yellow dock and bugleweed, and algae such as chlorella can all help remove toxic metals. These agents are natural chelating agents or antagonists.

Mineral therapy can help remove toxic metals. Each toxic metal has specific mineral antagonists that inhibit its absorption or metabolism. For instance, cadmium antagonists include calcium and zinc. Mercury antagonists include selenium. The antagonists include the physiological minerals needed to replace the toxic metals.

Enhancing the organs of elimination such as the skin, liver, kidneys and colon may also greatly facilitate the elimination of toxic metals. This is why saunas, massage, skin brushing, colonic irrigation, herbs for the liver and kidneys, bowel cleansing and other detoxification procedures may help eliminate toxic metals.

The most important method of eliminating toxic metals, in our experience, is to balance body chemistry and enhance energy production. Energy is required to eliminate toxic metals. Also, a balanced body chemistry will support the metabolism in ways that will facilitate the elimination of toxic metals.

The goal of all hair mineral analysis programs based on mineral balancing science is to support body chemistry and thus facilitate the removal of all toxic metals, as well as other toxic chemicals that cannot be read on any mineral test.

For more information on this topic go to [www.arltma.com](http://www.arltma.com) - Articles

## **COPPER**

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### **SOURCES OF COPPER**

Seafood - oysters, crabs, bluefish, perch, lobster

Meats - veal, duck, lamb, pork, beef liver and kidneys

Nuts/seeds - almonds, pecans, walnuts, filberts, brazil nuts, sesame, sunflower, pistachio

Vegetables - soybeans

Grains - wheat germ and bran

Miscellaneous - yeast, gelatin, bone meal, corn oil, margarine, mushrooms, chocolate

Other sources - copper water pipes, copper sulfate added to drinking water, copper compounds used in swimming pools, mineral supplements (especially prenatal vitamins), copper cookware and tea kettles, birth control pills, copper intrauterine devices, vegetarian diets, stress, exhaustion of the adrenal glands

Many children are born today with excessive copper levels passed to them from their mothers in utero.

### **ROLES IN THE BODY**

- Energy production
- Female reproductive system
- Blood formation

### **FUNCTIONS OF COPPER**

**Circulatory** - structure of blood vessels, aorta and heart muscle

**Blood** - formation of hemoglobin

**Nervous** - maintenance of the myelin sheath on nerves

**Reproductive** - essential for fertility, menstrual cycle

**Endocrine** - synthesis of stimulatory neurotransmitters

**Muscular/skeletal** - bone and connective tissue structure

**Immune system** - necessary for the immune system

**Integumentary** - needed for skin, hair, nails and pigments

**Energy** - energy production (the electron transport system)

### **SYMPTOMS ASSOCIATED WITH A COPPER DEFICIENCY**

anemia	edema	loss of hair color
atherosclerosis	fatigue	low hormone production
demyelination of nerves	hair loss	osteoporosis
diarrhea	impaired collagen formation	

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## Joe Sample

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### SYMPTOMS ASSOCIATED WITH A COPPER EXCESS

acne	fatigue	mind racing
adrenal insufficiency	fears	mood swings
allergies	fractures, bone	multiple sclerosis
alopecia	headaches (migraine)	myocardial infarction
anemia	hemorrhages	nausea
anorexia	heart disease	pancreatic dysfunction
anxiety	hyperactivity	premenstrual tension
arthritis	hypertension	schizophrenia
autism	hyperthyroidism	sexual inadequacy
cholesterol, elevated	hypochlorhydria	spaciness
cancer	hypoglycemia	strokes
cystic fibrosis	infections	tooth decay
depression, mental	inflammation	urinary tract infections
diabetes	insomnia	vitamin deficiencies
estrogen (imbalance)		

### SYNERGETIC NUTRIENTS

Absorption - proteins

### ANTAGONISTIC NUTRIENTS

Absorption - zinc, manganese, iron, calcium, molybdenum, sulfur, mercury, cadmium, vitamin C

Metabolic - zinc, vitamin C, vitamin B<sub>6</sub>, sulfur, molybdenum, manganese, iron

### HAIR ANALYSIS NOTES

- Bio-unavailable copper: Often copper status can be tricky to assess. Copper may be present, but unavailable for use in the body. This occurs any time adrenal gland activity is low.
- Copper and Oxidation Type: Fast oxidizers generally are deficient in copper, while slow oxidizers usually have either high copper or bio-unavailable copper.
- Hidden Copper Toxicity: Copper is often normal on hair tests, but may actually be locked in body tissues. Test indicators of a hidden copper imbalance are:
  - calcium level greater than 75 mg%
  - potassium level less than 3 mg%
  - sodium/potassium ratio less than 2.2:1
  - mercury toxicity often indicates a hidden copper toxicity
  - copper level less than 1.0 mg%
  - zinc/copper ratio less than 6:1

### REASONS FOR SUPPLEMENTATION WITH COPPER

- to raise a low sodium/potassium ratio
- to enhance retention of calcium in tissues

**MANGANESE**

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**SOURCES OF MANGANESE**

Meats - snails, egg yolk

Nuts/seeds - sunflower, coconuts, peanuts, pecans, walnuts, chestnuts, hazelnuts, almonds, brazil nuts

Fruits - blueberries, olives, avocados

Vegetables - corn, corn germ, parsley, legumes

Grains - wheat, wheat germ and bran, rice, barley, oats, buckwheat, rye

Miscellaneous - kelp, cloves, tea

**ROLES IN THE BODY**

- Energy Production, essential for
- Glucose tolerance levels, necessary for maintaining
- Tendons and ligaments, maintains integrity of
- Bone development, essential for

**FUNCTIONS OF MANGANESE**

*Nervous system* - synthesis of neurotransmitters

*Reproductive system* - fertility

*Endocrine system* - required for normal adrenal and thyroid gland activity

*Skeletal* - tendons, ligaments, connective tissue

*Metabolic* - energy production, glucose tolerance, utilization of fats and carbohydrates

*Detoxification* - involved in superoxide dismutase

**SYMPTOMS ASSOCIATED WITH A MANGANESE DEFICIENCY**

allergies	ringing in the ears
hypoglycemia	fatigue
diabetes	weakness, muscle
myasthenia gravis	bone fractures or osteoporosis
dizziness	weak ligaments and tendons

**SYMPTOMS ASSOCIATED WITH A MANGANESE EXCESS**

anorexia	schizophrenia
neurological symptoms	iron deficiency
ataxia	

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## Joe Sample

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### SYNERGETIC NUTRIENTS

zinc, choline, vitamin K

### ANTAGONISTIC NUTRIENTS

*Absorption* - calcium, phosphorus, iron, soy protein

*Metabolic* - copper, magnesium, iron, vanadium

### HAIR ANALYSIS NOTES

Manganese is called the maternal mineral because manganese-deficient animals cease to care for their young.

#### High Hair Manganese:

- may be due to manganese toxicity derived from drinking water containing excessively high levels of manganese.

#### Low Hair Manganese:

- low hair manganese levels are extremely common. However, if the manganese level is below .03 mg% it is considered very low.
- low manganese usually correlates with slow oxidation and low energy levels.

### REASONS FOR MANGANESE SUPPLEMENTATION

- to raise low sodium levels
- to lower excessive iron, copper or other toxic metal levels
- to correct a low sodium/potassium ratio



**ZINC**

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**SOURCES OF ZINC**

- Seafood - oysters, herring
- Meats - beef, lamb, beef and pork liver
- Nuts/seeds - sunflower, pumpkin
- Dairy - cheese
- Grains - wheat germ
- Miscellaneous - brewer's yeast, maple syrup, bone meal, gluten, tea

**ROLES IN THE BODY**

- Activator of many key enzymes
- Growth and development
- Male reproductive system
- Insulin production and secretion
- Prevention of cadmium and copper toxicity

**FUNCTIONS OF ZINC**

- Circulatory** - maintenance of artery walls
- Respiratory** - removal of carbon dioxide and maintenance of acid-base balance
- Digestive** - production of digestive enzymes, and normal liver function
- Nervous** - essential for brain development and neurotransmitters
- Special senses** - appetite regulation, smell and taste
- Reproductive** - testes, ovaries, prostate, male fertility
- Endocrine** - insulin and pituitary gonadotropin secretion
- Blood** - red blood cells and blood proteins
- Skeletal** - bone integrity, prevention of osteoporosis
- Skin** - required for normal integrity of hair, nails, and skin
- Protective** - required for wound healing and integrity of the immune system
- Metabolic** - normal carbohydrate and protein metabolism
- Detoxification** - assists in removing toxic accumulation of cadmium and copper
- Psychological** - powerful mood stabilizer and "sedative" mineral

**SYMPTOMS ASSOCIATED WITH A ZINC DEFICIENCY**

- |                                 |                         |
|---------------------------------|-------------------------|
| alcoholic cirrhosis             | fatigue                 |
| arteriosclerosis                | hypoglycemia            |
| cadmium toxicity                | hypothyroidism          |
| carbohydrate intolerance        | impotence               |
| copper toxicity                 | lack of taste and smell |
| conditions due to birth defects | low appetite            |
| diabetes                        | nervousness             |
| emotional problems              | poor wound healing      |
| failure to thrive               | prostate problems       |

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## Joe Sample

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### SYMPTOMS ASSOCIATED WITH A ZINC EXCESS

anemia, iron deficiency  
depression, mental  
diarrhea

nausea  
vomiting

### SYNERGETIC NUTRIENTS

magnesium, vitamin A, D, E, B<sub>6</sub>, high-protein diet

### ANTAGONISTIC NUTRIENTS

*Absorption* - copper, cadmium, iron, chromium, manganese, selenium, phytic acid, vegetarian diets, soy, cereals, fiber in diet

*Metabolic* - copper, iron, cadmium

### HAIR ANALYSIS NOTES

Zinc is considered a "masculine" mineral, because of its importance in the formation of male sexual hormones.

#### High Hair Zinc:

- An elevated zinc level is commonly due to a loss of zinc from the body tissues. In these cases, zinc supplements will often be recommended.
- Zinc levels may appear high to help compensate for copper toxicity. Thus high zinc can be a tipoff of a hidden copper toxicity.
- Use of Head and Shoulders shampoo occasionally results in an elevated zinc reading.
- Cadmium toxicity can cause a zinc reading to appear high.

#### Low Hair Zinc:

- Zinc will often read low if the sodium/potassium ratio is less than 2.5:1. In this case, it is not always wise to give much zinc.
- Zinc is commonly low in "fast" oxidizers.
- Very low zinc levels are often associated with emotional instability and with problems of growth and development in children.

## **CHROMIUM**

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### **SOURCES OF CHROMIUM**

Seafood - oysters  
Meats - calves' liver, egg yolk  
Nuts/seeds - peanuts  
Fruit - grape juice  
Dairy - American cheese  
Grains - wheat and wheat germ  
Miscellaneous - brewer's yeast, black pepper, molasses  
Dental partials

### **ROLES IN THE BODY**

- Glucose tolerance factor - chromium is involved in maintaining blood sugar levels and energy levels.
- Cholesterol regulation
- Other possible roles involved in the synthesis of DNA

### **FUNCTIONS OF CHROMIUM**

**Circulatory** - serum cholesterol regulation  
**Digestive** - sugar and carbohydrate utilization (via insulin)  
**Nervous** - maintenance of nervous system by regulation of blood sugar  
**Eyes** - corneal clarity  
**Muscular** - supplies energy for muscular contraction  
**Skeletal** - essential component of bones and hair  
**Protective** - immune system (via insulin)  
**Metabolic** - fat, protein, and carbohydrate metabolism regulation

### **SYMPTOMS ASSOCIATED WITH A CHROMIUM DEFICIENCY**

atherosclerosis	elevated serum cholesterol levels
depressed growth	fatigue
diabetes	hypoglycemia

### **SYMPTOMS ASSOCIATED WITH A CHROMIUM EXCESS**

asthma	kidney damages
allergies	sinusitis
calcium deficiency	ulcers
causes an iron deficiency	vomiting
diarrhea	

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## Joe Sample

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### SYNERGETIC NUTRIENTS

insulin, glucose, magnesium, vitamin B<sub>6</sub>, zinc, manganese oxalates, salicylates

### ANTAGONISTIC NUTRIENTS

Absorption - iron, manganese, zinc, vanadium, phytates

Metabolic - glucagon

### HAIR ANALYSIS NOTES

#### High Hair Chromium:

- a high chromium level is often indicative of a loss of chromium through the hair, and is frequently caused by an iron toxicity or another mineral imbalance problem.

#### Low Hair Chromium:

- supplementing with chromium when the chromium reading is low, is frequently helpful in correcting symptoms of fatigue, or sugar and carbohydrate intolerance.
- excessive iron intake is a frequent cause of both high and low chromium levels.

## SELENIUM

### SOURCES OF SELENIUM

Seafood - oysters, tuna, mackerel, herring, lobsters, scallops, shrimp, pike, trout, carp, cod, flounder, salmon

Meats - liver, kidney, heart, beef, lamb, egg, pork

Nuts/seeds - brazil nuts, cashews, peanuts, walnuts

Grains - wheat germ and bran, brown rice, barley

Miscellaneous - brewer's yeast

### ROLES IN THE BODY

- At the molecular level selenium as a sulfhydryl agent, anti-oxidant (glutathione peroxidase), and as a synergist to vitamin E.
- At the cellular level selenium is involved in the destruction of peroxides, protection of cell membranes, as an electron transfer agent, and in glutathione metabolism.
- Selenium helps maintain the circulatory system, digestive organs, and reproductive system. It is also involved with heavy metal detoxification.

### FUNCTIONS OF SELENIUM

*Circulatory* - needed for the heart muscle

*Excretory* - protection from toxic metals

*Respiratory* - involved in oxygen transport

*Digestive* - intestinal homeostasis

*Nervous* - protection from mercury and cadmium

*Reproductive* - protection against birth defects

*Endocrine* - synergistic with the sex hormones

*Blood* - stabilizes the red blood cell membranes

*Integumentary* - helps maintain hair, skin and nails

*Immune* - enhances immune system in animals

*Metabolic* - lipid and sulfhydryl metabolism; may prevent liver necrosis

*Detoxification* - helps remove mercury, cadmium, silver, arsenic and peroxides

### POSSIBLE SYMPTOMS ASSOCIATED WITH SELENIUM DEFICIENCY

acanthocytosis

alcoholic liver failure

neonatal jaundice

toxic metal poisoning

### POSSIBLE SYMPTOMS ASSOCIATED WITH EXCESSIVE SELENIUM

depression

dermatitis

gastrointestinal distress

liver damage

mottled teeth

nervousness

pallor

possibility of malignancy

selenosis

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## Joe Sample

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### **NUTRIENTS THAT ARE SYNERGISTIC WITH SELENIUM**

*Metabolic* - vitamin C, vitamin E, glutathione

*Absorption* - amino acids, peptides, proteins

### **ANTAGONISTIC NUTRIENTS**

*Metabolic* - silver, arsenic, mercury, cadmium, titanium

*Absorption* - copper, mercury, silver, sulfate

### **HAIR ANALYSIS NOTES**

#### **High Hair Selenium:**

- can be due to the use of shampoos containing selenium
- may indicate a loss of selenium through the hair

#### **Low Hair Selenium:**

- may be due to dietary deficiency, which is relatively common, especially among those who eat refined foods

### **REASONS FOR SELENIUM SUPPLEMENTATION**

Selenium may be given to help prevent or correct cadmium, mercury, or arsenic toxicity. Selenium is an antioxidant and may be given to help protect against free radical damage. Note that excessive selenium supplementation may be toxic.

## **PHOSPHORUS**

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### **SOURCES OF PHOSPHORUS**

Seafood - tuna, mackerel, pike, red snapper, salmon, sardines, whitefish, scallops, shad, smelt, anchovies, bass, bluefish, carp, caviar, eel, halibut, herring, trout

Meats - liver (beef, chicken, hog, lamb), rabbit, sweetbreads, turkey, beef brains, chicken, eggs, egg yolk, lamb heart, kidney

Nuts/seeds - pinon, pistachios, pumpkin, sesame, sunflower, walnuts, almonds, brazil nuts, cashews, filberts, hickory, peanuts, pecans

Vegetables - chickpeas, garlic, lentils, popcorn, soybeans

Dairy - cheeses

Grains - wheat bran and germ, wild rice, buckwheat, millet, oats, oatmeal, brown rice, rice bran, rye, wheat

Miscellaneous - chocolate, kelp, yeast, bone meal

### **ROLES IN THE BODY**

Bone structure - 80-85% of phosphorus in the body is located in the bones and teeth

Energy production - (ATP - adenosine triphosphate and ADP - adenosine diphosphate)

Cell membranes - (as phospholipids)

Genetic reactions - in DNA - deoxyribonucleic acid and RNA - ribonucleic acid

Buffering agent, to maintain osmotic pressure

### **FUNCTIONS OF PHOSPHORUS**

**Digestive** - regulates absorption of calcium and a variety of trace elements. Phosphorus in excess has a laxative action

**Nervous** - source of adenosine triphosphate (ATP), component of the myelin sheath

**Endocrine** - interacts with vitamin D

**Blood** - red blood cell (RBC) metabolism

**Muscular** - adenosine triphosphate (ATP) needed for muscle contraction

**Skeletal** - component of bone and teeth

**Immune** - adenosine triphosphate (ATP) for leukocytes

**Metabolic** - energy production via phosphorylation reactions

**Detoxification** - in liver - via adenosine triphosphate (ATP)

### **SYMPTOMS ASSOCIATED WITH A PHOSPHORUS DEFICIENCY**

arthritis

tooth decay

fatigue

stunted growth

fragile bones

weakness, muscle

reproductive problems

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## Joe Sample

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### SYMPTOMS ASSOCIATED WITH A PHOSPHORUS EXCESS

anemia (iron deficiency)

arthritis

calcium and magnesium deficiency

diarrhea

hyperexcitability

irritability

tremors

zinc deficiency

### SYNERGETIC NUTRIENTS

*Absorption* - sodium, potassium, low calcium diet, vitamin D, parathyroid hormone, high fat diet

*Metabolic* - calcium, magnesium, B-complex vitamins (in energy production)

### ANTAGONISTIC NUTRIENTS

*Absorption* - calcium, aluminum, iron, magnesium, vegetarian diets, vitamin D deficiency

### HAIR ANALYSIS NOTES

#### High Hair Phosphorus:

- An elevated phosphorus level is frequently indicative of excessive protein breakdown of body tissues. As proteins break down, phosphorus is released.
- Phosphorus levels may increase temporarily as toxic metals are being eliminated in the course of a nutrition program.
- Very high phosphorus (greater than 25 mg%) can indicate a serious metabolic disturbance.
- Pubic hair samples often show elevated phosphorus readings. This is a characteristic of pubic hair.

#### Low Hair Phosphorus:

- A low phosphorus level is frequently associated with inadequate protein synthesis.
- Although most diets are adequate in phosphorus, those on low-protein diets or vegetarians may have a low phosphorus intake.
- Zinc is required for protein synthesis. Often a low phosphorus level is associated with a zinc deficiency, cadmium toxicity, or zinc loss. When these imbalances are corrected, the phosphorus level improves.
- A low phosphorus level may be due to poor digestion or assimilation of protein. This may be due to digestive enzyme deficiency, low hydrochloric acid level, or other factors.



## **MERCURY**

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### **SOURCES OF MERCURY TOXICITY**

- tuna fish, swordfish, shark and tile fish
- contaminated drinking water
- dental amalgam (silver fillings)
- seeds and vegetables treated with mercurial fungicides
- medications - diuretics, Mercurochrome, Merthiolate, Preparation H, contact lens solution
- occupational exposure - felt, algicides, floor waxes, adhesives, fabric softeners, manufacture of paper, production of chlorine
- children can be born with mercury toxicity that is passed through the placenta from their mothers. Mercury can also be passed to children in breast milk.

### **DETECTION OF MERCURY TOXICITY**

Both blood and hair have been used to detect mercury poisoning. In one study, hair levels generally correlated with blood levels. Hair levels are about 300 times higher than blood levels.

Copper toxicity and zinc deficiency are often associated with mercury toxicity.

### **HOW MERCURY AFFECTS HEALTH**

**Energy** - mercury compounds inhibit the enzyme ATPase, which impairs energy production in all body cells.

**Nervous System** - degeneration of nerve fibers occurs, particularly the peripheral sensory nerve fibers. In addition to sensory nerve damage, motor conduction speed was reduced in persons with high hair mercury levels.

The most common sensory effects are paresthesia, pain in limbs, and visual and auditory disturbances. Motor disturbances results in changes in gait, weakness, falling, slurred speech, and tremor. Other symptoms are headaches, rashes and emotional disturbances.

**Endocrine System** - mercury has been shown to concentrate in the thyroid and pituitary glands, interfering with their function. Impairment of adrenal gland activity also occurs.

**Kidneys** - mercury can accumulate in the kidneys, where it may cause kidney damage.

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## Joe Sample

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### POSSIBLE CONDITIONS ASSOCIATED WITH MERCURY TOXICITY

adrenal gland dysfunction	kidney damage
alopecia (hair loss)	loss of self-control
anorexia	memory loss
ataxia (uncontrolled movement of limbs)	migraine headaches
birth defects	mood swings
blushing	nervousness
brain damage	numbness and tingling in arms and legs
depression	pain in limbs
dermatitis	rashes, skin
discouragement	salivation, excessive
dizziness	schizophrenia
fatigue	thyroid dysfunction
hearing loss	timidity
hyperactivity	tremors
immune system dysfunction	vision loss - peripheral vision
insomnia	weakness, muscle

## **CADMIUM**

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### **SOURCES OF CADMIUM TOXICITY**

- food grown on cadmium contaminated soil - sewage sludge, fertilizers, and irrigation water can contaminate the soil
- large ocean fish - tuna, cod, haddock
- refined and processed foods
- processed meats, cola drinks and instant coffee
- cigarette smoke
- contaminated drinking water
- occupational exposure - battery manufacture, semiconductors, dental materials
- solder used in food cans
- motor oil and exhaust fumes from cars
- artists paints
- air pollution - incineration of rubber tires, plastic and paints

Children today are commonly born with cadmium toxicity passed from mother to child via the placenta.

### **DETECTION OF CADMIUM TOXICITY**

"...Cadmium data from blood have little diagnostic value" (Cranston & Passwater, 1983). This is because cadmium is rapidly removed from the blood soon after it is ingested.

Blood challenge tests can detect cadmium in the blood and arteries.

Cadmium levels in hair show good correlation with cadmium levels in the kidneys. Often, however, several months of nutritional therapy and several hair tests are required before cadmium is revealed in the hair.

### **HOW CADMIUM AFFECTS HEALTH**

**Energy** - cadmium causes strong inhibition of essential enzymes in the Krebs energy cycle.

**Nervous System** - cadmium inhibits release of acetylcholine and activates cholinesterase. This results in a tendency for hyperactivity of the nervous system.  
Cadmium also directly damages nerve cells.

**Bones and Joints** - cadmium alters calcium and phosphorus metabolism, thus contributing to arthritis, osteoporosis and neuromuscular diseases.

**Cardiovascular System** - cadmium replaces zinc in the arteries, contributing to brittle, inflexible arteries.

**Digestive System** - cadmium interferes with production of digestive enzymes that require zinc.

**Male Reproductive System** - prostate problems and impotence can result from cadmium-induced zinc deficiency.

**Endocrine System** - zinc is required for growth and insulin release. Cadmium can contribute to failure to thrive, delayed growth development and diabetes.

**Excretory System** - cadmium accumulates in the kidneys, resulting in high blood pressure and kidney disease.

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## Joe Sample

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**Dental** - alterations in calcium and vitamin D activity, caused by cadmium toxicity, can result in cavities and tooth deformities.

**Psychological** - cadmium toxicity is associated with learning disorders and hyperactivity. This may be due to zinc deficiency, or to inhibition of acetylcholine release in the brain.

### POSSIBLE CONDITIONS ASSOCIATED WITH CADMIUM TOXICITY

alopecia (hair loss)

anemia

atherosclerosis

arteriosclerosis

arthritis, osteo

arthritis, rheumatoid

bone repair, inhibited

cancer

cardiovascular disease

cerebral hemorrhage

cholesterol, elevated

cirrhosis of the liver

diabetes

emphysema

enlarged heart

failure to thrive syndrome

fertility, decreased

hyperlipidemia (high levels of fat  
in blood)

hyperactivity in children

hypertension

hypoglycemia

inflammation

lung disease

migraine headaches

osteoporosis

renal (kidney) disease

schizophrenia

sex drive, reduced

strokes

vascular disease

## **ALUMINUM**

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It is in no way intended to reflect the findings in this report.*

### **SOURCES OF ALUMINUM TOXICITY**

- beverages from aluminum cans (soda pop and beer)
- food cooked in aluminum cookware
- use of aluminum-containing antacids
- use of anti-perspirants
- drinking water (aluminum is frequently added to municipal water)
- baking powders
- drying agents in salt and other products
- processed cheese
- bleached flour
- fluoridated water increases leaching of aluminum from aluminum pots and pans
- dental crowns and inlays

Today children are often born with elevated aluminum that is passed from mother to fetus through the placenta.

### **DETECTION OF ALUMINUM TOXICITY**

There is debate whether blood testing for aluminum has much value. Blood levels definitely do not indicate total body load of aluminum.

Hair aluminum levels appear to correlate well with bone levels of aluminum. Several hair tests may be needed before aluminum is revealed on the test. This is because the aluminum may be tightly bound within body tissues, and several months on a nutrition program may be required to mobilize the aluminum.

### **HOW ALUMINUM AFFECTS HEALTH**

**Nervous System** - in animal studies, aluminum blocks the action potential or electrical discharge of nerve cells, reducing nervous system activity. Aluminum also inhibits important enzymes in the brain (Na-K-ATPase and hexokinase). Aluminum may also inhibit uptake of important chemicals by nerve cells (dopamine, norepinephrine, and 5-hydroxytryptamine).

**Behavioral Effects** - dementia resulting from kidney dialysis related to aluminum toxicity causes memory loss, loss of coordination, confusion and disorientation.

**Digestive System** - aluminum reduces intestinal activity, and by doing so can cause colic.

### **POSSIBLE CONDITIONS ASSOCIATED WITH ALUMINUM TOXICITY**

Early symptoms of aluminum toxicity include: flatulence, headaches, colic, dryness of skin and mucous membranes, tendency for colds, burning pain in head relieved by food, heartburn and an aversion to meat.

Later symptoms include paralytic muscular conditions, loss of memory and mental confusion.

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## Joe Sample

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### **OTHER POSSIBLE CONDITIONS ASSOCIATED WITH ALUMINUM TOXICITY**

Alzheimer's disease

amyotrophic lateral sclerosis

anemia

hemolysis, leukocytosis, porphyria

colitis

dental cavities

dementia dialactica

hypoparathyroidism

kidney dysfunction

liver dysfunction

neuromuscular disorders

osteomalacia

Parkinson's disease

peptic ulcer

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