# What is tissue mineral analysis?

TISSUE MINERAL ANALYSIS (TMA) of the hair is an analytical test that assays the mineral composition of the hair. As a screening test in the preventive health care field, hair analysis is proving invaluable as clinical results continue to validate its increasing use. Interpreted correctly, tissue mineral analysis data may provide indications of mineral imbalances, deficiencies and excesses of many essential and toxic elements. Despite certain limitations discussed later in this information booklet, trace mineral analysis of the hair can greatly assist the doctor in assessing a patient's health and nutritional status. Used in conjunction with other familiar diagnostic tests, hair analysis data can provide a more holistic and comprehensive picture upon which to base the most effective nutritional therapy.

## What does hair tissue reflect?

Hair is formed in the dermis from a cluster of matrix cells that make up the follicle. During the growth phase, metabolic activity is greatly increased, exposing the hair to the internal metabolic environment. This includes the extracellular fluids, circulating blood and lymph. As the hair reaches the surface of the skin, its outer layers harden, locking in the metabolic products accumulated during this period of hair formation.

Hair is the second most metabolically active tissue and by the very nature of its formation as a biological sample, may provide a permanent record of the metabolic activity occurring within the body during its period of growth. The first inch and one-half (ie 4 cm) of hair closest to the scalp from the occipital region can provide a good indication of the nutrient and toxic metal exposure over the previous eight to sixteen weeks. A mineral deficiency or excess revealed in the hair test can indicate a possible deficiency, excess or bio-unavailability of that mineral within the body.

***Tissue mineral analysis is a good indicator of the metabolic processes occurring within the cells (intracellular).***

Investigators in the United States, Germany, England, Sweden, Canada, Poland and Japan have shown that concentrations of elements in the hair provide an accurate and permanent record. A close correlation was noted between tissue trace element levels in the hair and internal organs.

Hair is used as the tissue of choice by the Environmental Protection Agency in determining toxic metal exposure. A 1980 report from the EPA stated that human hair can be effectively used for biological monitoring of the highest-priority toxic metals. This report confirmed the findings of other studies that concluded that human hair may be a more appropriate tissue than blood or urine for studying community exposure to some trace metals.

## Is blood as good an indicator of mineral status as hair?

The blood and serum do contain minerals, but they may not be completely representative of the body's mineral storage. In many cases, the serum level of minerals is maintained at the expense of tissue concentration (homeostatic mechanisms). Serum concentrations may fluctuate with emotional changes, the time of day the blood is drawn, or foods eaten prior to taking a sample. For example, serum magnesium can fluctuate depending upon the blood drawing technique. The longer the tourniquet is applied, the higher the magnesium rises as a result of tissue hypoxia. Also symptoms of iron deficiency can be present long before low serum levels can be detected, as iron deficiency symptoms before anaemia are very common.

***Blood analysis for minerals is a good indicator of the transport of minerals to and from the storage areas of the body (extracellular).***

Excess accumulation of minerals in the body are often undetected in the serum due to their removal from the blood for deposition into the tissues. When this occurs, the mineral may fail to be excreted through the urine or intestinal tract. Thirty to forty days following an acute exposure to the toxic metal lead, for instance, elevated serum levels may be undetectable as a result of the body's removing the lead from the serum as a protective measure and depositing the metal into such tissues as the liver, bones, teeth and hair.

Minerals may fluctuate between the serum and tissues in acute or chronic conditions. This is seen with copper and iron during infections, inflammatory disorders, and certain malignancies. Also, calcium loss from the body can become so advanced that severe osteoporosis develops without any appreciable changes noted in the blood levels of calcium.

## Advantages of hair analysis

- Hair specimens can be collected more quickly and easily than blood, urine or any other tissue, using a non-invasive method.
- Hair analysis is more cost-effective than trace mineral testing through other means.
- Unlike blood, hair is less susceptible to the homeostatic mechanisms that quickly affect trace element levels.
- Long term deviations of mineral retention or losses are more easily detected in hair than blood.
- Concentrations of most elements in the hair are significantly higher than those found in the blood and other tissues.
- Hair provides a record of past as well as present trace element levels, ie biological activity.
- Hair provides information about substances entering the hair from the blood serum as well as from external sources.
- Hair is invaluable in the assessment of toxic metal levels.

## Why test for minerals?

In the words of the late Dr. Henry Schroeder, trace elements (minerals) "are more important than are the vitamins, in that they cannot be synthesised by living matter. Thus they are the spark-plugs in the chemistry of life, on which the exchanges of energy in the combustion of foods and the building of living tissues depend."

Dr. Emanual Cheraskin states in his book, *Diet and Disease*, "Minerals have interrelationships with every other nutrient. Without optimum mineral levels within the body, the other nutrients are not effectively utilised."

Minerals are also necessary in the production of hormones. For example, manganese and copper are necessary for catecholamine synthesis; zinc is involved in the production, storage, and secretion of insulin and is also necessary for growth hormones.

Another important function of the essential minerals is their necessity for enzyme activity RNA construction. Minerals are involved with enzymes in two ways: they make up a part of, or are contained within, the enzyme (metaloenzyme), and they act as enzyme activators.

**Enzymes that require Zinc:**

| | |
|---|---|
| Carbonic Anhydrase | Alkaline Phosphatase |
| Carboxypeptidase | Alcohol Dehydrogenase |
| Lactic Dehydrogenase | Plasma RNase |

**Enzyzmes that require Copper:**

| | |
|---|---|
| Cytochrome C Oxidase | Uricase |
| Dopamine Hydroxylase | Tyrosinase |
| Super Oxide Dismutase | Ascorbic Acid Oxidase |

**Enzymes that require Iron:**

| | |
|---|---|
| Cytochrome C Oxidase | Xanthine Oxidase |
| Cytochrome C Reductase | NADH Dehydrogenase |
| Peroxidase | Aconitase |

## Biochemical individuality

New investigations in biochemistry, physiology, and nutrition are continually supporting the concept of biochemical individuality. The following early investigators developed or correlated findings in their fields to support the basis of individual biochemical requirements.

Roger Williams, PhD, published research data showing that children of the same family had significantly different nutritional needs. One child required several times more of a particular nutrient than the other. Adults of the same age and size in similar environmental settings also showed several-fold differences in their nutritional requirements in order to maintain health. Dr. Williams referred to this as "biochemical individuality."

Melvin Page, DDS, of the Page Foundation, determined metabolic types by using anthropometric measurements of the upper and lower extremities in conjunction with blood parameters and other physical characteristics. He noted that his findings correlated with certain neurological and endocrine characteristics, which he termed "sympathetic" and "parasympathetic" dominance.

George Watson, PhD, also recognised biochemical individuality. He developed categories according to cellular oxidation rates. Oxidation is the process by which ATP (adenosine triphosphate) ultimately is formed. ATP is the major energy constituent of the cell normal functioning of the glycolysis and Krebs cycles are required for adequate ATP production. Each step of these two energy production cycles requires individual nutrients for its completion. A lack of or an excess of specific nutritional factors can contribute to a reduced or accelerated cellular oxidation rate. Thus, Dr. Watson used the terms "fast" and "slow" oxidation types.

## Metabolic types

Further research has increased our ability to recognise metabolic types more definitively through tissue mineral patterns of the hair. Dr. David L. Watts has found that certain mineral patterns reveal metabolic characteristics that correlate well with the descriptions of the earlier investigators.

***Metabolism is a term used to describe nutrient utilisation or efficiency on a cellular level resulting in energy production and maintenance. Cellular metabolism is controlled by neurological and endocrine function, which will affect nutrient absorption, retention and excretion.***

Dr. Watts has conducted clinical research in tissue mineral analysis by correlating over 200,000 tissue mineral analyses with specific physical and biochemical characteristics. As a result, eight distinct metabolic categories can be identified through a properly obtained and assayed sample.* These include, the fast and slow metabolic types, each with their four sub-types.

The metabolic types with their sub-categories can generally be associated with the various stages of stress, whether acute or chronic in nature. Developed by Hans Selye, these are the alarm, resistance, recovery and/or exhaustion stages. Metabolic typing through TMA allows these stages of stress to be more easily determined, and therapy can then be made specific by working with rather than against the body's normal responses to stress.

The following descriptions will briefly define the characteristics of Fast and Slow Metabolism and the neuro-endocrine combinations of the sub-categories.

*Sample washing and preparatory procedures will vary from laboratory to laboratory. Improper methods and procedures will adversely affect those mineral patterns, ie ratios, that are critical for this method of determining metabolic types, as developed by Trace Elements Inc.

### Fast Metabolism

Fast Metabolism is synonymous with Sympathetic Dominance, Fast Oxidation and Type A personality. Excessive sympathetic nervous system activity increases the availability of glucose for rapid metabolism via epinephrine release from the adrenal medulla. The adrenal medulla stimulates other areas of the body that are not directly innervated by sympathetic nerve fibres and can increase the metabolic rate by as much as 100 percent.

The fast metaboliser's cellular oxidation is more than adequate in pyruvate and oxaloacetic acid production, but inadequate in the production of acetates. This results in incomplete energy production in the Krebs cycle. The fast metaboliser is in a state of rapid glycolysis, which accounts for the high metabolic rate. High HCI with tissue acidity and low pancreatic enzyme production are usually present also.

The fast metaboliser is usually experiencing a considerable amount of stress (physical, emotional, or a combination of both). He or she often enjoys stressful situations and may even seek them out. This type of person is usually late for appointments, somewhat agitated or hyperexcitable, and is often considered a workaholic. If the metabolism becomes too fast, he begins to experience more emotional stress, especially anxiety about the future. The blood pressure may become elevated, with accompanying dental problems and excessive perspiration. Frequently, an increased need to eat develops in order to maintain high energy levels. Weight gain will usually occur in the abdominal region.

**Fast Metabolism Type 1:** Classified as sympathetic dominant with increased adrenal activity and increased thyroid function. This synchronous neuro- endocrine combination will frequently result in increased energy levels. However, if an imbalance develops between the adrenal and thyroid glands, the ability to sustain energy levels may become diminished. The Fast Metaboliser Type 1 can develop TMA patterns associated with an alarm, resistance or recovery stage of stress.

**Fast Metabolism Type 2:** Classified as sympathetic dominant with increased adrenal cortical activity and lowered thyroid function. This imbalanced neuro-endocrine combination reflects the alarm stage of stress. When the adrenal cortex becomes dominant over thyroid activity, energy fluctuations may become dramatic. Often the Type 2 individual will experience an increase then a decrease in energy levels, which can contribute to significant mood swings.

**Fast Metabolism Type 3:** Classified as sympathetic dominant with decreased adrenal cortical activity in conjunction with increased thyroid function. This imbalanced neuro-endocrine combination is indicative of the resistance or exhaustion stage of stress and is often associated with depression and irritability if chronic.

**Fast Metabolism Type 4:** Classified as sympathetic neurological dominance with decreased adrenal activity and decreased thyroid glandular function. This neuro-endocrine combination is associated with the exhaustion stage of stress, often reflected in extreme fatigue, depression, and anxiety.

## Slow Metabolism

Slow Metabolism is synonymous with parasympathetic Dominance, Slow Oxidation and Type B personality. Generally speaking, the slow metabolic types metabolise glucose at a reduced rate. If slow metabolism is severe, energy production and maintenance of normal energy levels will become inadequate. This is a result of the inability to split glucose molecules to form adequate amounts of pyruvates and oxaloacetic acid in the glycolysis cycle. This then leads to the inability to produce citric acid in the Krebs cycle. Low HCI and tissue alkalinity are also usually present.

Slow metabolisers are most often well organised and methodical. They tend to start projects and see them through to completion. Often regarded as perfectionists, they perform best when not under stress. If the metabolic rate becomes excessively reduced they are subject to fatigue, requiring extra amounts of rest. They eventually experience depression, often dwelling upon the past. Blood pressure may decrease below normal, and they may develop cold hands and feet. Weight gain will usually be noticed on the thighs and hips. If the metabolism continues to decrease, protein food (especially meats) will become poorly tolerated which may then increase their tendency toward vegetarianism.

**Slow Metabolism Type 1**: Classified as parasympathetic dominant with decreased adrenal medullary activity and decreased thyroid function. This synchronous neuro-endocrine combination will result in sustained energy levels (endurance); however, the production of energy will be below optimum. The slow metaboliser Type 1 can experience any one of the four stages of stress.

**Slow Metabolism Type 2:** Classified as parasympathetic dominant with increased adrenal cortical activity and decreased thyroid function. This imbalanced neuro-endocrine combination is indicative of the alarm stage of stress. When the adrenal cortex is dominant relative to the thyroid, energy fluctuations may become pronounced. The slow metaboliser Type 2 will normally experience both elevated and depressed energy levels, which can contribute to significant mood swings.

**Slow Metabolism Type 3:** Classified as parasympathetic dominant with decreased adrenal cortical activity and increased thyroid function. This imbalanced neuro-endocrine combination is indicative of the resistance or exhaustion stages of stress. When chronic, slow metabolism Type 3 is often associated with depression and irritability.

**Slow Metabolism Type 4:** Classified as parasympathetic dominant with high adrenal activity in conjunction with elevated thyroid function. This imbalanced neuro-endocrine combination is usually a result of an acute alarm stage of stress that has progressed into the stage of resistance.

# Endocrine/mineral relationships

The mineral patterns found in the hair reflect the internal metabolic environment. These TMA patterns are greatly influenced by the endocrine glands and are largely a reflection of endocrine activity that contributes to increased absorption, retention and excretion of trace elements.

The endocrine glands of the body are similar to minerals, in that they possess antagonistic and synergistic relationships. Figures 1-3 show the endocrine and mineral relationships as indicated by current research. Figure 1 illustrates the antagonistic relationship of the endocrines. Increased activity of one gland will have a suppressing effect upon another. A decrease in the activity of a gland will in turn allow increased expression of an opposing gland, or will alter tissue sensitivity to its hormone. Any alteration in endocrine activity will have an influence on mineral metabolism, absorption, retention and excretion.

Figure 2 illustrates the endocrine glands that are dominant in the fast metaboliser and the effect they have upon mineral retention and excretion. These endocrines have synergistic or reciprocal relationships and can be classified as catabolic. Calcium and phosphorus are affected primarily, resulting in an increase in phosphorus retention and an increase in calcium loss or excretion. Frequently, when phosphorus is retained, sodium and potassium retention also occurs. Concurrently, a reduction in calcium retention is usually accompanied by a loss of magnesium.

Figure 3 shows the synergistic glands that are associated with slow metabolism and parasympathetic dominance. These glands can be classified as anabolic. An increase in activity of these glands will influence the retention of calcium relative to phosphorus. When calcium is retained, magnesium retention also occurs, along with increased sodium and potassium excretion or loss.

The influence of the endocrine glands on mineral metabolism will have a definite effect on the tissue mineral patterns found in the hair and other tissues of the body, producing deficiencies, imbalances and excess accumulation. The endocrines may in turn be affected by appropriate nutritional therapy, thereby reversing or preventing further metabolic disturbances produced by their relative dominance and/or inhibitory effects.

## TMA endocrine indicators

Tissue mineral analysis is an ideal method of assessing endocrine influence on mineral metabolism, especially absorption and retention.

FIGURE 1.

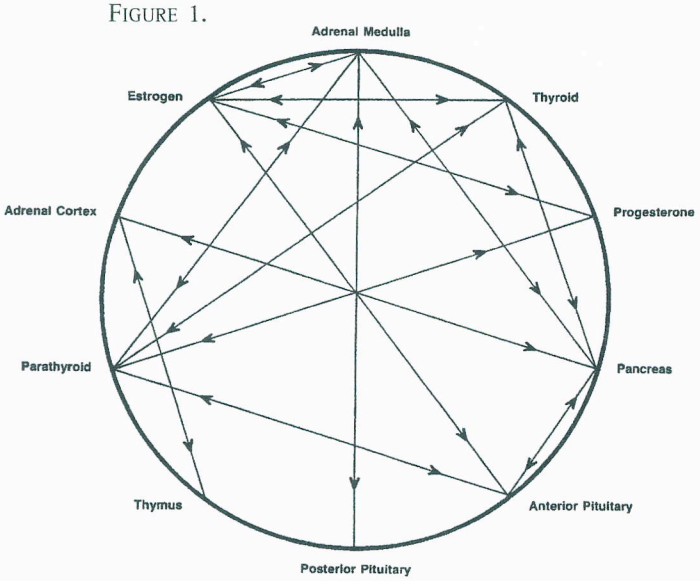



FIGURE 2.

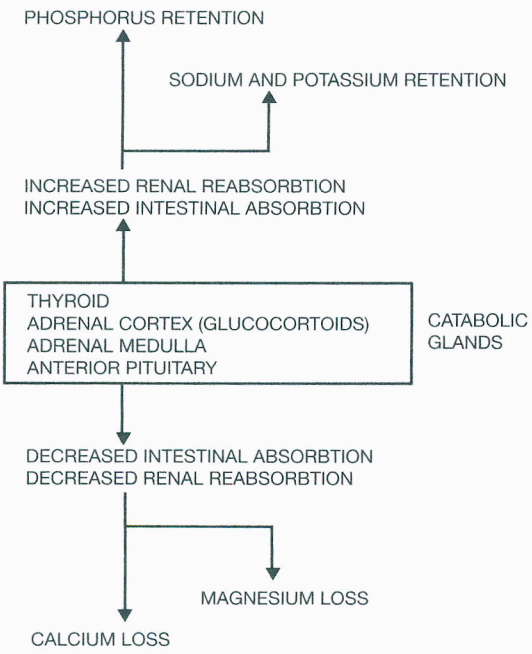
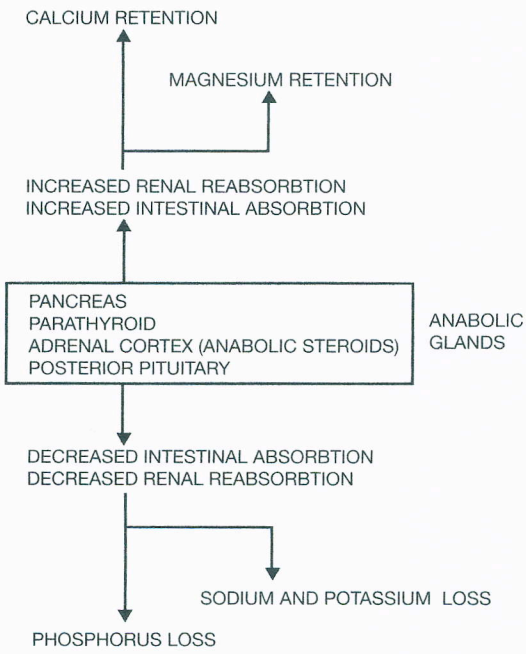



FIGURE 3.



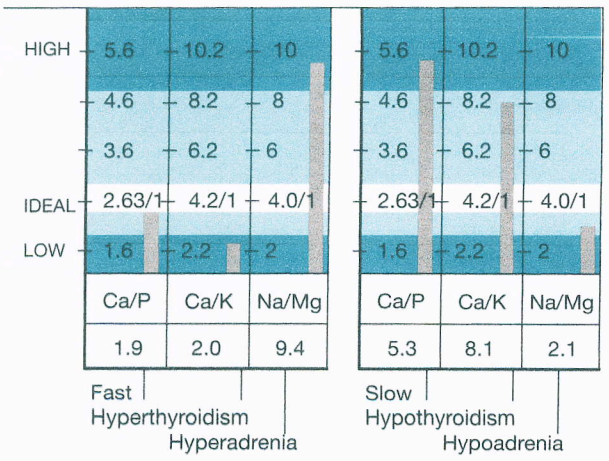
Dr. Melvin Page described the parasympathetic types as having a dominance of the anabolic glands, which, as illustrated previously, include the pancreas, parathyroid, adrenal cortex and posterior pituitary. These glands affect calcium retention in the body relative to phosphorus. An elevated calcium to phosphorus ratio is seen in a slow metaboliser's hair analysis.

The sympathetic biochemical type is dominant in catabolic glandular activity. These glands include the thyroid, adrenal medulla and anterior pituitary. Increased catabolic glandular activity increases phosphorus retention in the tissues relative to calcium. A low calcium to phosphorus ratio in the hair is indicative of fast metabolism.

**Thyroid activity:**
Thyroid activity is often indicated by the tissue calcium to potassium ratio. Potassium is necessary to sensitise the tissues to the effects of thyroxin. Studies have shown that in hypothyroid states, the intestinal absorption of calcium increases with lower than normal calcium excretion via the kidneys. The ideal calcium to potassium ratio in hair tissue is 4.2 to 1, as determined by T.E.I. research. Elevation of calcium in relation to potassium indicates a trend toward hypothyroidism, while a low tissue calcium to potassium ratio indicates a trend toward hyperthyroidism.

**Parathyroid activity:**
Increased parathyroid hormone activity can directly increase the renal tubular absorption of magnesium. High tissue magnesium suggests of increased parathyroid activity, while low tissue magnesium suggests decreased parathyroid function.

## Nutritional ratios




NOTE: These examples of tendencies only, and should not be considered diagnostic.

**Adrenal activity:**
The adrenal cortex produces mineralocorticoid hormones. The primary function of these hormones is to regulate the electrolytes, sodium and potassium. Hair tissue studies of these two minerals, in conjunction with other mineral levels and ratios, can give an indication of adrenal activity.* Production of the mineral corticoid aldosterone is usually higher in the fast metaboliser than in the slow. Increased aldosterone production may be indicated by excessive tissue sodium relative to magnesium levels.

*Sample preparation and testing methods of different labs will produce variation in sodium and potassium results. Tissue mineral indicators can therefore vary from one lab to another.

## Causes of mineral imbalance

Many factors can contribute to mineral imbalances. As Dr. Ashmead stated in his book, *Chelated Mineral Nutrition in Plants, Animals and Man,* "There are at least eighteen barriers to mineral absorption, which means that the minerals we consume do not necessarily wind up in our bodies."

**Diet:** A major factor contributing to a mineral imbalance is improper eating habits. Excessive intake of refined carbohydrates, alcohol and fad diets can all lead to poor mineral nutrition. Even the mineral content of a "healthy" diet can be inadequate, depending upon the soil in which the food was grown or the method by which it was prepared.

**Stress:** Stress, either physical or emotional, can lead to mineral imbalances. Certain nutrients such as the mineral zinc and the B-complex vitamins are lost in greater quantities due to increased stress. Nutrient absorption can also decrease when the body is under stress.

**Medications:** Medications can deplete the body store of nutrient minerals or increase the levels of toxic metals. The well-known effects of diuretics include sodium loss and in many cases, a potassium and magnesium loss. Antacids, aspirin and oral contraceptive agents can lead to vitamin and mineral deficiencies as well as toxic metal excesses.

**Pollution:** Toxic metals such as lead, mercury and cadmium can interfere with mineral absorption and increase mineral excretion. From adoles-

cence to adulthood the average person is continually exposed to a variety of toxic metal sources such as cigarette smoke (cadmium), car exhaust (lead), copper and aluminium cookware, hair dyes (lead), lead based cosmetics, hydrogenated oils (nickel), antiperspirants (aluminium) and dental amalgams (mercury and cadmium). These are just a few of the hundreds of sources an individual may be exposed to every day.

**Genetic and individual factors:** Inherited predispositions and individual metabolic dysfunctions affect biochemical balances and nutritional requirements.

**Nutritional supplements:** Vitamin and mineral supplements can also lead to mineral imbalances. Calcium absorption is decreased in the presence of excess phosphorus. Vitamin C is required for iron absorption, but in excess amounts it can cause a copper deficiency. Vitamin D enhances calcium absorption but, in excess amounts, can produce a magnesium deficiency, etc.

## Conditions associated with mineral imbalances

Continuing research is showing that many health conditions can be attributed to, or aggravated by various mineral imbalances and toxic metal excesses.

**Arteriosclerosis**: Excessive calcium deposition on the arteries is higher in areas of the world with magnesium deficient soils and water. Magnesium is required in sufficient amounts to maintain a resistance to excessive calcium in the soft tissues of the body. An abnormal calcium to magnesium relationship can be readily identified through tissue mineral testing. The abnormal relationship of these minerals is not always revealed by other diagnostic tests.

**Hypercholesterolaemia:** Excess serum cholesterol and increased incidence of heart disease have been related to a low serum copper to zinc ratio. High zinc to copper ratios found in the tissues should warrant further investigation.

**Hypertension:** High sodium intake has long been associated with hypertension. Recent evidence now indicates that other minerals can protect the body from the adverse affects of sodium. Calcium to sodium levels, and magnesium to sodium ratios may show a trend toward high blood pressure. They can also indicate preventative or control measures through supplementation and dietary modifications.

**Hyperactivity:** Research reveals a strong relationship between hyperactivity in children and toxic metals such as cadmium, lead, and mercury, as well as high levels of iron, manganese and copper.

**Migraines:** Excessive nutrient mineral accumulation as well as toxic metals such as cadmium, mercury and lead can contribute to migraine headaches.

**Learning disabilities:** Toxic metals such as lead have been implicated in learning disabilities and attention deficit disorders. Deficiencies of certain minerals have been shown to be associated with decreased academic performance.

***"Through proper interpretation, there exists a unique ability to recognise abnormal processes from trace mineral patterns found in the hair and other tissues. With specific dietary modifications, restoration of a more normal biochemical balance can be achieved, thereby eliminating many nutritionally related endocrine, neurological and even emotional disturbances."***
David L. Watts. PhD.

## What suggests a need for tissue mineral analysis?

Tissue mineral analysis is a screening tool that can be applied in any phase of therapy and any area of the health care field. If a patient is suffering from an illness or syndrome and the cause cannot be identified through ordinary testing procedures, or if therapy is not completely effective, hair analysis can be very helpful. Tissue mineral testing reveals a unique metabolic world - *cellular metabolic activity* - which cannot be measured through most other tests. A hair tissue test can help pinpoint metabolic disturbances as well as indicate the appropriate corrective clinical approach.

Ideally, hair analysis should be used once a year to evaluate toxic metal exposure and accumulation and to check essential nutrient balances.

## What to expect from a TMA evaluation and program

The laboratory provides excellent clinical data for all minerals routinely tested. The laboratory offers advanced interpretations that help you to determine which mineral imbalances are present to identify the factors contributing to your patient's condition. This, in conjunction with our highly specific dietary and supplement recommendations, can help you formulate a therapeutic program to decrease toxic metal burdens and restore a more normal biochemical balance.

After starting the rebalancing program, the patient may experience symptomatic changes very quickly, usually within 10 to 20 days. If an excess body burden of toxic metals exists, the patient may develop temporary discomfort during this period of elimination. Such discomfort can usually be alleviated by temporarily reducing the supplement program. This is suggested, particularly if the patient becomes too uncomfortable during a toxic metal elimination.

## When to retest

Since the supplements and other recommendations are so specific, we suggest that the patient retest after 60 and before 90 days if they are observing the program. This is necessary to follow the patient's progress and to make changes in the nutritional recommendations as required.

NOTE: If a follow-up analysis is not performed in 90 days we suggest that the TMA report recommendations be discontinued.

## Mineral levels reported

With each TMA test, the report will graphically depict and list the hair tissue mineral levels of thirty-six (36) trace elements, using a bar graph presentation. The report is laid out in an easy-to-read format highlighting three main groups: Nutrient, toxic and additional minerals.

| **Nutrient minerals analysed:** | | |
|---|---|---|
| Calcium | Magnesium | Sodium |
| Potassium | Copper | Zinc |
| Phosphorus | Iron | Manganese |
| Chromium | Selenium | Boron |
| Cobalt | Molybdenum | Sulfur |

| **Toxic minerals analysed:** | | |
|---|---|---|
| Arsenic | Beryllium | Mercury |
| Cadmium | Aluminium | Lead |
| Uranium | Antimony* | |

| **Additional minerals analysed:** | | |
|---|---|---|
| Barium | Lithium | Nickel |
| Platinum | Strontium | Tin |
| Titanium | Tungsten | Zirconium |
| Thallium | Bismuth | Germanium |
| Vanadium | Rubidium | |

*Subject to availability

## Mineral ratios reported

Each report also highlights over 25 important mineral ratios, grouped: significant ratios, toxic ratios and additional ratios.

| Significant ratios: | |
|---|---|
| Calcium to Phosphorus | (Ca/P) |
| Sodium to Potassium | (Na/K) |
| Calcium to Potassium | (Ca/K) |
| Zinc to Copper | (Zn/Cu) |
| Sodium to Magnesium | (Na/Mg) |
| Calcium to Magnesium | (Ca/Mg) |
| Iron to Copper | (Fe/Cu) |

| Toxic ratios: | |
|---|---|
| Calcium to Lead | (Ca/Pb) |
| Iron to Lead | (Fe/Pb) |
| Iron to Mercury | (Fe/Hg) |
| Selenium to Mercury | (Se/Hg) |
| Zinc to Cadmium | (Zn/Cd) |
| Zinc to Mercury | (Zn/Hg) |
| Sulfur to Mercury | (S/Hg) |
| Sulfur to Cadmium | (S/Cd) |
| Sulfur to Lead | (S/Pb) |

| Additional ratios: | |
|---|---|
| Calcium to Strontium | (Ca/Sr) |
| Chromium to Vanadium | (Cr/V) |
| Copper to Molybdenum | (Cu/Mo) |
| Iron to Cobalt | (Fe/Co) |
| Potassium to Cobalt | (K/Co) |
| Potassium to Lithium | (K/Li) |
| Magnesium to Boron | (Mg/B) |
| Sulfur to Copper | (S/Cu) |
| Selenium to Thallium | (Se/Tl) |
| Selenium to Tin | (Se/Sn) |
| Zinc to Tin | (Zn/Sn) |

# Guide to nutritional supplement recommendations

Years of research and clinical observations have lead to the recognition of the stimulating and sedating effects of nutrients upon metabolism. In continuing these observations, Dr. Watts has classified nutrients into one of the following two categories: metabolic stimulating or metabolic sedating. Some examples follow:

| STIMULATING | SEDATING |
|---|---|
| Sodium | Calcium |
| Potassium | Copper |
| Phosphorus | Magnesium |
| Vitamin E | Vitamin D |
| Vitamin B6 | Zinc |
| Purines | Fats |
| Softened Water | Hard Water |

Vitamins and minerals also exhibit synergistic and antagonistic effects upon one another. Minerals may interfere with or reduce the absorptive potential of other nutrients, or they may enhance and complement the absorption and utilisation of another nutrient. The majority of multi vitamin-mineral supplements currently available contain many antagonistic relationships that ultimately reduce the supplement's clinical effectiveness. Each essential mineral alone has over twenty different factors that determine its therapeutic efficacy. Recognition of these nutrient interactions is a crucial step in designing an effective nutritional program.

Taking into consideration the various nutrient interactions and individualised requirements of specific biochemical types, responsible nutritional therapy requires more than a "balanced" multi vitamin/mineral supplement. This is why a method of testing that detects imbalances as well as indicating the correct procedure for restoring a normal balance is important. A shotgun approach to nutritional therapy can often produce other deficiencies and excesses. For example:

**Calcium supplementation:** Excess calcium intake can produce a phosphorus and magnesium deficiency resulting in symptoms almost identical to that of a calcium deficiency. A continued loss of magnesium will contribute to increased sodium retention and eventually a vitamin A deficiency, etc.

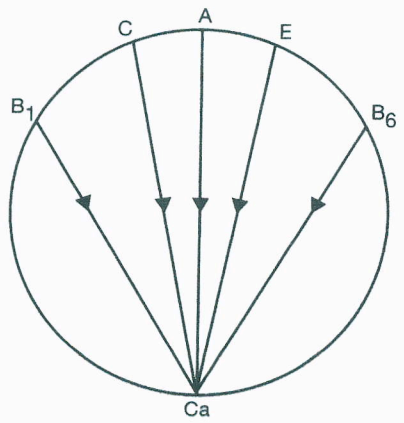
**Zinc supplementation:** Over an extended period of time, zinc can produce a copper or iron deficiency as well as causing a sodium to potassium imbalance. Excess zinc accumulation can produce conditions usually associated with zinc deficiency, such as lowered resistance, fatigue, hair loss and prostatitis, as well as symptoms of vitamin D deficiency.

**Iron supplementation:** Taken alone for prolonged periods, iron supplements can result in anaemia. This is due to iron's antagonism to copper. Copper is necessary for the utilisation of iron and if deficient can cause excess iron accumulation within the tissues, thereby not allowing iron to be incorporated into the haemoglobin molecule.

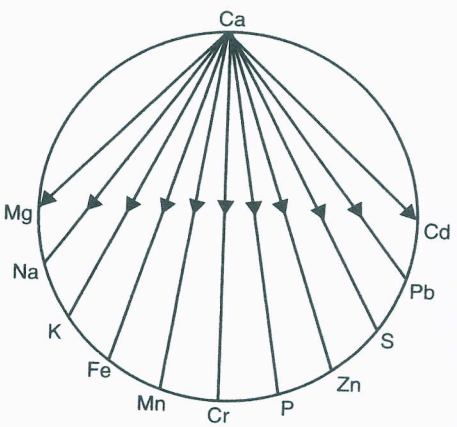
**Vitamin supplementation:** Vitamins supplements can be a double-edged sword. Vitamin C deficiency can result from excess amounts of copper and iron. Excessive intake of vitamin C, when tissue copper level is marginal, can eventually produce symptoms of vitamin C deficiency. The vitamins B1 and B2 are known to be mutually antagonistic. Excessive intake of one can lead to a deficiency of the other.

NB: Each set of individualised patient supplement

VITAMINS THAT ANTAGONISE CALCIUM




MINERALS ANTAGONISED BY CALCIUM




NOTE: Any one or a combination of these minerals in excess can also antagonise calcium.

recommendations contained within the profile 2 and 3 TMA reports take into consideration over 300 nutritional factors.

**Trace Nutrients**™ are a unique line of nutritional support formulae that complement tissue mineral analysis findings and sympathetic and parasympathetic requirements. The formulations are based on the study and clinical experience of over 20 years nutritional research by Dr. David L. Watts. These clinically advanced formulations are based on sound nutritional principles, they offer hypo-allergenic, synergistic support and they can provide assistance in areas of specialty individual needs.

With proper application, better monitoring techniques and more predictable results, nutritional therapy can play a more valuable role in health care. For further details regarding the Trace Nutrients™ professional product line please contact InterClinical Laboratories.

## The laboratory

Trace Elements Inc (TEI) is an internationally recognised US tissue mineral analysis laboratory and nutritional consulting company. The laboratory is federally licensed, following strictly established health and safety protocols, and is regularly inspected by the Clinical Laboratory Division of the US Department of Health and Human Services (License no. 45-DO481787).

TEI employs the finest state-of-the-art technology and the most experienced analytical and support staff to ensure scientifically accurate data and reports. TEI uses ICP-Mass Spectrometry (Perkin Elmer 6100/9000), one of the most sensitive analytical techniques available for mineral analysis today. All testing is performed in a trace element class laboratory clean room, using the most advanced and uniform temperature-controlled microwave digestion techniques (CEM Mars 5 Plus).

Each patient result from TEI is based on a National Institute of Standards and Technology (NIST) standard curve, a rigorous quality control validation for tissue specimens. The result is also compared with a representative reference range derived from similar analysis of an international collection of normal and 'healthy' subjects.

High sensitivity balances used by the laboratory for weighing specimens and checking calibration/quality control standards are calibrated with weight sets from NIST. All stock standards used for daily calibration and quality control are prepared by a leading certified ISO 9001 laboratory.

TEI is committed to precision, reliability and good overall laboratory practices. The laboratory participates in an ongoing quality assurance/quality control (QA/QC) program. Monthly QA/QC studies are conducted to confirm and validate all aspects of test methodology, personnel training, laboratory reporting, safety, etc. Aspects of laboratory performance are also continuously evaluated before, during and after each daily analytical run, eg. reagents, QC reference materials from the National Institute of Standards and Technology, split specimen analysis, spiked samples, calibration-verification studies and routine daily monitoring of patient data trends.

TEI voluntarily participates in inter-laboratory test comparison surveys. For example, the laboratory is involved in an ongoing program run by Le Centre de Toxicologie du Quebec, in Canada. This program compares the results of urine, blood and hair elemental testing from North American and European clinical laboratories using high resolution instrumentation.

TEI provides laboratory testing, interpretations and nutritional consultations exclusively to health care professionals. It also provides individualised nutritional programs designed for patients based on their laboratory test results. The laboratory also conducts continuing research and education, disseminating information to clients that can be applied in clinical practice.

Unrivaled quality assurance protocols and participation in inter-laboratory research programs are part of our commitment to the field of tissue mineral analysis and to providing the clinician with the finest analytical data and interpretative reports.