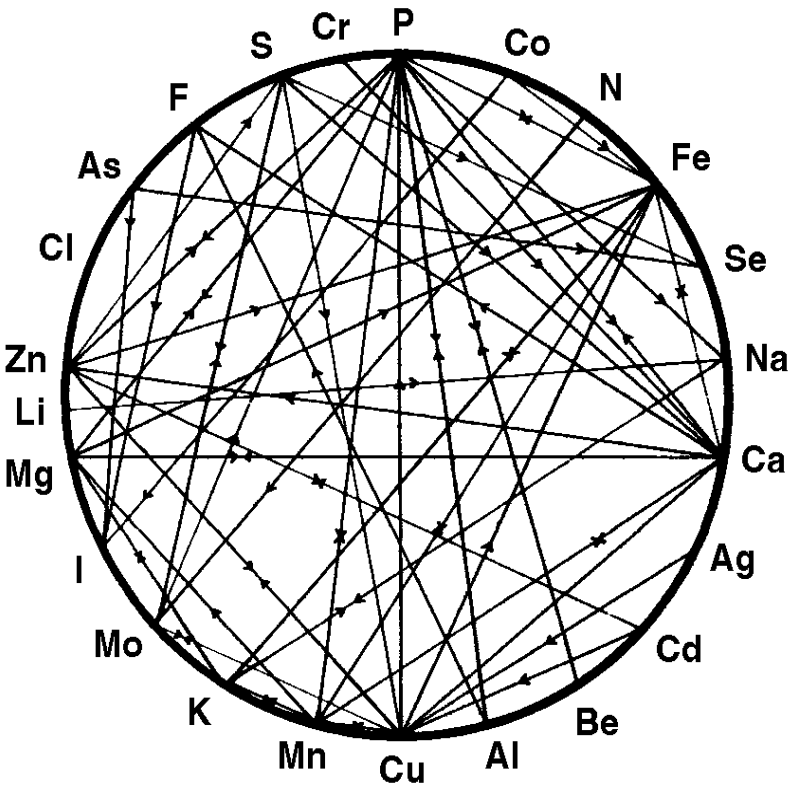
Lesson 1 - What is Tissue Hair Mineral Analysis (THMA)?

Providing a mineral blueprint of one's biochemistry, a hair tissue mineral analysis can provide pertinent information about your metabolic rate, energy levels, sugar and carbohydrate tolerance, stage of stress, immune system and glandular activity.

Tissue hair mineral analysis or THMA is a soft tissue mineral biopsy that uses hair as the sampling tissue. A biopsy is an analysis of a body tissue. Hair is considered a soft tissue, and hence hair analysis is a soft tissue biopsy.

The test measures the levels of 20 or more minerals in the hair with an accuracy of plus or minus about 3%. This is about the same level of accuracy as most blood tests, or a little better. However, for the best accuracy, especially of the water-soluble elements, the hair sample must not be washed at the hair testing laboratory. The preparation of the hair sample at the laboratory is a debate that exists among the laboratories that offer hair mineral testing.

As an aside, hair is extremely useful for testing many things besides minerals. These include drugs, toxic chemicals and DNA. Hair is frequently used in forensic medicine, and in drug testing clinics. It is also used worldwide for biological monitoring of many animal species for toxic metals.



Why measure minerals?

Minerals are sometimes called the ‘sparkplugs’ of the body. They are needed for millions of enzymes as co-factors, facilitators, inhibitors and as part of the enzymes themselves. By analyzing mineral imbalances in the body, one can learn a lot about the causes and correction of hundreds of common physical and mental health conditions.

As you progress through the course you will learn the importance of the major minerals in the body and the ratios between them. This is a more complex area, but a very important and fruitful one. Finally, by studying more complex patterns of minerals in the body, one can learn even more about human health and disease.

Why use hair for measuring minerals?

Hair makes an excellent biopsy material for many reasons:

- Sampling is simple and non-invasive.
- Hair is a stable biopsy material that remains viable for years, if needed, and requires no special handling.
- Mineral levels in the hair are about ten times that of blood, making them easy to detect and measure accurately in the hair.
- Hair is a fairly rapidly growing tissue.
- The body often throws off toxic substances in the hair, since the hair will be cut off and lost to the body.
- Mineral levels are kept relatively constant in the blood even when pathology is present. Hair mineral values often vary by a factor of ten or much more, making measurement easier and providing a tremendous amount of accurate knowledge about the cells and the soft tissue of our bodies.
- Toxic metals are easier to detect in the hair than in the blood. They are not found in high concentrations in the blood except right after an acute exposure. However, most tend to accumulate in the soft tissues such as the hair, as the body tries to move them to locations where they will do less damage.
- Hair testing provides a long-term reading, while blood tests and urine tests provide a more instantaneous reading of the body. Both types of readings have value in some circumstances. For example, blood tests can vary from hour to hour, depending upon one’s diet, activities, the time of day and many other factors. This is beneficial in some instances, but is often less helpful when seeking an overall metabolic reading. These problems are not present with hair testing. At times, of course, an instantaneous reading such as the blood provides is needed, especially in emergencies, which is an area in which hair testing is not used.
- Finally, advancements in computer-controlled mass spectroscopy and other technologies have rendered the hair mineral biopsy an extremely cost-effective, accurate and reliable test when it is performed well.

Controversies in hair mineral analysis

The acceptance of hair mineral testing as a valid medical procedure has been slowed by several disagreements among researchers who use hair mineral testing. These are:

- Should the hair be washed at the testing laboratory, and if so, how should it be washed, for how long, and with what type of cleaning agent(s)?
- Can one recommend diets, lifestyle changes and supplements from a hair mineral analysis?
- How severe is the problem of contamination of the hair with dust and dirt?
- To what degree to shampoos, rinses, tints, dyes and other hair treatments damage the hair sample and ruin the test?
- How accurate is the test, and what do the numbers mean?

The accuracy of hair mineral analysis

Mineral analysis by spectroscopy is a very standard laboratory procedure. The technology has been known for at least 75 years or more, and has improved greatly with the advent of computer-controlled mass spectrometers and induction-coupled plasma (ICP) instruments that are used today at all the hair testing laboratories in America, and probably around the world.

All commercial hair testing laboratories in the United States are licensed and inspected annually by the federal government, as part of the CLIA act. They are given blind samples to run. If they do not meet stringent criteria for accuracy, they are not allowed to operate.

The United States Environmental Protection Agency published a 300-page review of hair analysis in 1979 which they reviewed 400 studies of hair analysis. Based on this review, they concluded that hair analysis is a "meaningful and representative tissue for biological monitoring for most of the toxic metals". ("Toxic Trace Metals in Human and Mammalian Hair and Nails", EPA-600 4.79-049, August 1979, US Environmental Protection Agency, Research and Development.)

Washing the hair at the laboratory

A major controversy surrounding hair mineral analysis concerns the preparation of the hair samples for testing at the laboratory. Most of the laboratories wash the hair samples before performing the analysis.

Arguments in favor of washing the hair at the laboratory

1. Hair is exposed to the elements and may be contaminated with dust, dirt, bacteria and other possible contaminants.

2. Hair may contain residues of hair products such as shampoo and other skin care products. Even the water that the patient bathes in could be contaminated with toxic metals or other minerals.

3. Any minerals that would be washed out due to washing the hair at the lab are “exogenous”, meaning they are not really part of the biopsy material and are thus not important.

4. Therefore, they contend, the advantages of washing the hair outweigh any possible negative consequences that might result.

Arguments against washing the hair at the laboratory

1. Most people wash their hair frequently, and the lab requires that the hair be washed within about 24-48 hours of cutting the sample

2. Washing the hair with harsh chemical solvents and detergents can and does remove large amounts of the water-soluble elements, and perhaps others. This is reported in all of the studies of this subject.

3. Hair is about 10-15% porous, so the washing agents not only remove exogenous minerals, but affect the interior of the hair tissue as well.

There are a number of studies that have been done on this subject, as follows:

· Leroy, R. (J Ortho Med., 1986;1(2)).

· Seidel, et al. (JAMA, 2001, 285, #1). The authors compared hair test results from about six labs. The results of the two laboratories that do not wash the hair samples showed excellent correlation, whereas the results from the laboratories that wash the hair were not quite as consistent. One must obtain the actual test numbers or data to realize this, as the details are not mentioned in the body of the study.

· Assarian , GS and Oberleas, D., (Clin Chem., 1977;23(9):1771-1772).

Results of the studies

All of the above studies indicated that washing hair samples at the laboratory causes some degree of erratic and unpredictable removal of minerals from the hair sample. This is also my clinical experience, based on reviewing about 40,000 hair mineral analyses. A number of these were repeat tests done in close succession by different laboratories. In most cases, there were significant variations in the results when one of the labs washed the hair and the other did not. Results were very close, however, when both labs did not wash the hair.

Conclusions from these studies

These include:

1. Errors in the levels of particularly the water soluble minerals (sodium, potassium, and gto some degree zinc, copper, manganese, and magnesium) due to the erratic effects of washing are far worse than the possibility of contamination.

2. Hair is a human tissue that is porous, and thus applying harsh chemicals to it is likely to penetrate inside the biopsy material and wash out some of the loosely-bound minerals.

3. Hair samples should not be washed at the lab, except if there is known contamination. In this case the sample can be rinsed quickly in alcohol so as not to remove the water soluble, loosely bound minerals.

Damaging the reputation of hair mineral analysis

A second, related problem with washing the hair at the lab is that most laboratories use:

1) different washing chemicals and

2) different washing duration.

The agents used to wash the hair include alcohol, detergents such as Triton-x, and solvents such as acetone. The duration of washing the hair samples varies from lab to lab, from three minutes to about ten minutes.

These differences result in some variation in the test results from laboratory to laboratory. It means that researchers and physicians will not receive the same results from two different labs that wash the hair. There have been efforts to standardize the laboratory procedures. So far, the laboratories that wash the hair have been unwilling to cooperate on hair washing standards, however.

For the best accuracy, there are two labs that do not wash the hair before analyzing it:

Analytical Research Labs

Trace Elements, Inc.

What about the effect of daily showering?

Research performed at Accutrace Laboratories indicates that showering is not the same as washing at the lab because:

* The hair is under the shower usually for only 15-60 seconds.

* While the hair is on the head, the oil and sweat glands of the scalp are able to reestablish the equilibrium concentrations of the washed out minerals rapidly after showering. These concentrations probably depend upon many subtle factors, such as the electrostatic potential of the hair fibers.

* Shampoos are not nearly as powerful as the detergents and solvents used at hair analysis labs.

Other common sources of hair contamination

Daily swimming in pools can increase sodium and copper readings. Selsun Blue Shampoo can increase selenium levels. Head and Shoulders Shampoo can increase zinc readings. Grecian Formula and Youth Hair hair dyes increase lead levels. Otherwise, in my experience, hair products have little effect upon the readings. None of these instances invalidates the hair test, in my experience. Practitioners can simply ask the patients which hair products they are using, and if they swim often in pools. Most laboratory tests, including blood tests, urine tests and others, have certain situations that tend to affect the test that must be considered when interpreting the test. Hair testing is no different from other tests in this regard.

Ask about washing procedures before submitting hair samples

Practitioners using hair mineral analysis should call and ask the lab about their washing procedure. This will affect particularly the levels of magnesium, sodium, potassium, manganese, zinc, copper and perhaps a few others. The toxic metal readings are not too affected by washing, presumably because they are less water-soluble and/or they are more tightly bound to the hair tissue or perhaps less easily dislodged by the washing chemicals.

Controversy due to two AMA journal studies and other medical reviews of hair mineral analysis

Two widely publicized articles published in the Journal of the American Medical Association claimed hair analysis was inaccurate. Both were so poorly done that in my view they hardly deserve to be analyzed. However, in the interest of fairness, let us review them.

The first article appeared in 1985 (*JAMA* 254(8)1041-1045). The author is a psychiatrist who admitted he had never used hair analysis in his medical practice and had no experience with it. He is also a well-known medical “quackbuster” who controls some 30 websites dedicated to discrediting and debunking holistic therapies.

For this study, he cut long pieces of his teenage daughter's hair. This is a direct violation of the protocol for hair sampling. One should never use long hair for hair analysis. This is specified in the instructions from all commercial laboratories. Long hair unravels and mineral readings become unreliable.

The author then washed his daughter's hair samples in kitchen tap water. This is another direct violation of hair sampling protocol. One should never wash hair that has been cut for sampling in any kind of water. Tap water, of course, generally contains a variety of random minerals. This warning is also mentioned in hair sampling instructions supplied by hair testing laboratories, but was ignored.

Then he cut the hair into small pieces and mixed them by hand. This is also unacceptable protocol. Hair is quite electrostatic and sticks together. It cannot be effectively mixed this way. The proper way to mix samples would have been to powder the hair and then mix it properly with a mixing machine.

The author then sent samples of the hair to 13 laboratories. Four of the laboratories showed excellent correlation between the results. Three others showed moderate correlation between the results, and six others did not correlate as well. Based on this, the author concluded that hair analysis is a fraud.

In the study conclusion, no mention was made of the fact that hair testing laboratories use different hair washing procedures that will yield differing results, and this fact was not taken into account in the discussion of the results of the testing.

Also, the references for the study were wholly inadequate and no mention was made, for example, of the US EPA review of 400 hair analysis studies that had been completed only 6 years before. This review concluded that hair testing was reliable and meaningful for testing the levels of the toxic metals, which is all the study addressed.

This JAMA study was widely circulated to the mainstream media and has influenced many physicians, even though it was so poorly done that it should never have been published in the first place.

The 2001 JAMA "Study"

The second study appeared in JAMA #285 (1), Jan. 3, 2001. For this study, six hair samples were cut from one woman's head. The hair sampling procedure was correct, and the hair samples were sent to six different hair testing laboratories to compare the results.

The odd thing about this study was that one of laboratories chosen to test the hair was operating illegally, as it had performed badly on tests and had lost its operating licence. The authors could have chosen many other labs for their study.

When the results came back, the worst performing lab was the illegal one. Based on this fact alone, the authors concluded that hair mineral analysis is inaccurate and probably a fraud.

The flaws in this study are obvious:

1. Why anyone would use an illegally-operating laboratory to study a scientific procedure makes very little sense unless the goal was to discredit hair mineral testing. It is like testing a new operation, but having someone who is not qualified do the operation.

2. Another flaw in this study is that only one person was involved. This is nothing but anecdotal evidence, and not a scientific study which one can draw statistically significant results from.

3. The references were horribly inadequate. As with the first JAMA study, no mention was made of the hundreds, if not thousands of previous studies of hair mineral testing that show it is a valid, accurate, reliable testing method.

4. To their credit, the authors mentioned that washing procedures vary among laboratories and this will influence results. However, they ignored their own statement in their conclusion, where they did not attempt to separate out the results by which labs washed the hair.

5. In fact, the two laboratories that do not wash the hair showed superb correlation of the readings. This finding was completely ignored by the authors.

This is discussed in more detals below and it is worthy of all students to understand the criticisms and methodology weakenesses of this study in order to defend their science.

The 'Nightline' expose on hair analysis

In this report from the late 1980s, hair from a dog was sent to a commercial hair analysis laboratory. The Nightline personnel led the laboratory to believe it was a human hair sample. They did not tell the laboratory it was from a dog. Identifying the species from which hair is sampled is the standard and an obvious procedure.

When results came back, they were very odd because the normal mineral values for a dog are very different than for humans. The television host claimed that this was a healthy dog and that such odd results proved that hair analysis is a fraud.

Of course, if one sent a dog's blood to a blood laboratory and did not tell the laboratory it belonged to a dog, the exact same thing would happen. This, of course, was not pointed out in the Nightline piece.

This is again further discussed in more detail below.

The June 12-13, 2001 Centers For Disease Control Report On Hair Analysis

The CDC review of hair analysis was actually just a meeting of a panel of "experts". The panel reviewed 10 studies of hair analysis. Among the 10 were

the two poor studies published in JAMA mentioned above. (Recall that the EPA reviewed 400 studies of hair analysis in 1979.)

No independent research was done by the CDC. After a short meeting, the panel concluded hair analysis is not reliable.

Interpreting Hair Mineral Analysis

Every mineral level affects every other mineral level

Another area of controversy concerns the interpretation of the hair mineral analysis. Often, hair analysis is viewed like a SMAC 24 or other test, in which each mineral value is regarded as a separate test. While this will yield some information, others suggest that the test must be interpreted as a whole system, not as 20 or more separate tests.

Dr. William Albrecht, PhD first described the 'mineral system' of the body, which are the way the minerals in the body relate to one another. He designed the “mineral wheel “to indicate some of the interactions that exist between minerals. Since then, much more work has been done to identify mineral relationships.

By analyzing the mineral ratios and relationships, information can be derived about organ and gland function, mental and emotional tendencies, how the body is responding to stress and how to support the body nutritionally. Many disease 'trends' can also be identified, making hair analysis an excellent and cost-effective preventive and predictive tool.

Does hair mineral interpretation involve Metabolic Typing and the stress theory of disease?

Dr. Paul Eck and a few other researchers interpret hair analysis by identifying the stage of stress a person is in, and the oxidation type and rate. However, this idea is quite controversial. Those who do not believe this are content to interpret the test much like one would interpret a blood or urine test for minerals, and not bother with metabolic typing and stress theory.

Dr. Eck's approach has proven extremely accurate in its ability to predict a client’s symptoms, and the ability of this theory to suggest a correct diet and proper supplementation to balance body chemistry. The use of stress theory and metabolic typing also simplifies the interpretation and makes it much easier to understand and learn.

Can one recommend a diet and nutritional supplements from a hair analysis?

Some say this is not possible, as the test only reads mineral levels. However, those who use hair analysis clinically find that it is possible to suggest food and nutrient therapies from the test for several reasons:

- Some foods and nutrients assist the body when it is in a particular stage of stress or metabolic type. Dr. Geroge Watson found that slow oxidizers need more B-complex vitamins, for example, and less fat in their diets.
- Some foods and nutrients are more helpful to correct certain mineral deficiencies. For example, cooked vegetables are rich in many minerals such as manganese, iron, chromium and selenium.
- Certain foods and nutrients can assist the body to remove toxic metals. For example, vitamin C can chelate and lower copper, while calcium-containing foods or supplements can help reduce the level of lead and cadmium.

The textbook written by Dr. Lawrence Wilson, M.D. covers this topic in much more detail and is entitled: *Nutritional Balancing and Hair Mineral Analysis*.

Why are hair test results sometimes different from blood and urine tests?

Their meaning is not different at all, in my experience. However, one must be able to interpret the hair and the blood tests correctly to understand how they relate to each other. Few doctors understand both types of tests well enough to do this. A few of the major differences between hair testing and other common tests include:

- The hair measures a different body compartment than the blood or urine. Each has its own metabolism.
- The blood is maintained at the expense of tissues such as the hair. This means the hair will change first, often years before the blood. The blood is far more buffered. It has to be because it touches every cell. Large variations in mineral levels here would be fatal. This is not the case with the hair.
- The hair is a storage organ and, to some degree, an excretory tissue. The blood is a transport medium.
- Blood, urine and saliva provide short-term or even instantaneous readings, whereas a hair test provides a 3-month average or a longer-term reading.
- Homeostatic mechanisms at work in the blood such as buffering of pH and osmotic balance are extremely different from homeostatic mechanisms at work in the tissues and at the cellular level in the hair.

If hair testing is so helpful, why is it not used more?

There are a number of factors that explain why the hair test is not used more often by other practitioners:

- Ignorance of the importance of trace mineral nutrition, toxicology and the critical importance of toxic metal poisoning in the causation of all the major killer diseases.

- Opposition from allopathic medical boards, and mainstream journals such as JAMA that have published phony studies to discredit hair testing.
- Misuse of the test just to measure toxic metals. This does not work well as the test is not showing the total load of the body but only what has been circulating in the blood over the last couple of months.
- Misuse of the hair test to do replacement therapy. This does not work well, either. Replacement therapy is when the doctor prescribes the minerals that read low on the test, and tells the patient to avoid the minerals that read too high. This way of using hair tests completely ignores important principles such as the bioavailability of a mineral, mineral defenders, mineral displacement and others. The failure of replacement therapy unfortunately causes most doctors to abandon hair mineral testing.

What minerals are tested?

THMA provides a measure of the chemical elements deposited in the cells and between the cells of the hair. It provides a reading of the deposition of the mineral in the hair during the 2-3 months during which the hair grew. It does not measure the total body load of any mineral, as some claim.
At least 20 elements are measured, depending on the laboratory. The three classes of these elements are:

- Macrominerals include calcium, magnesium, sodium, potassium and phosphorus. Some labs also read sulfur.
- Trace Minerals include iron, zinc, copper, manganese, selenium, chromium, and some labs measure others.
- Toxic Minerals include lead, mercury, cadmium, arsenic, aluminum, and nickel. Some labs read others as well. Toxic metals will be discussed in more length in another lesson.

How is hair mineral testing used today by doctors?

Doctors tend to use the hair mineral test in one of four basic ways:

- A majority of physicians and other practitioners use hair mineral testing for the detection of high levels of toxic metals. This needs a specific methodology - see Dr. George J Georgiou's paper entitled: Using Hair Tissue Mineral Analysis to Make Clinical Decisions.
- A smaller number of doctors use the test also for the detection of low levels of trace minerals or electrolytes such as calcium, magnesium, sodium, potassium, phosphorus and sulfur. Most then practice replacement therapy to raise the levels of the trace minerals.
- An even smaller number of physicians follow the recommendations of Dr. David Watts and others, who use the test for some metabolic determinations such as the adequacy of the thyroid and adrenal glands, blood sugar tolerance, and patterns indicating infections, inflammation and a few other conditions.

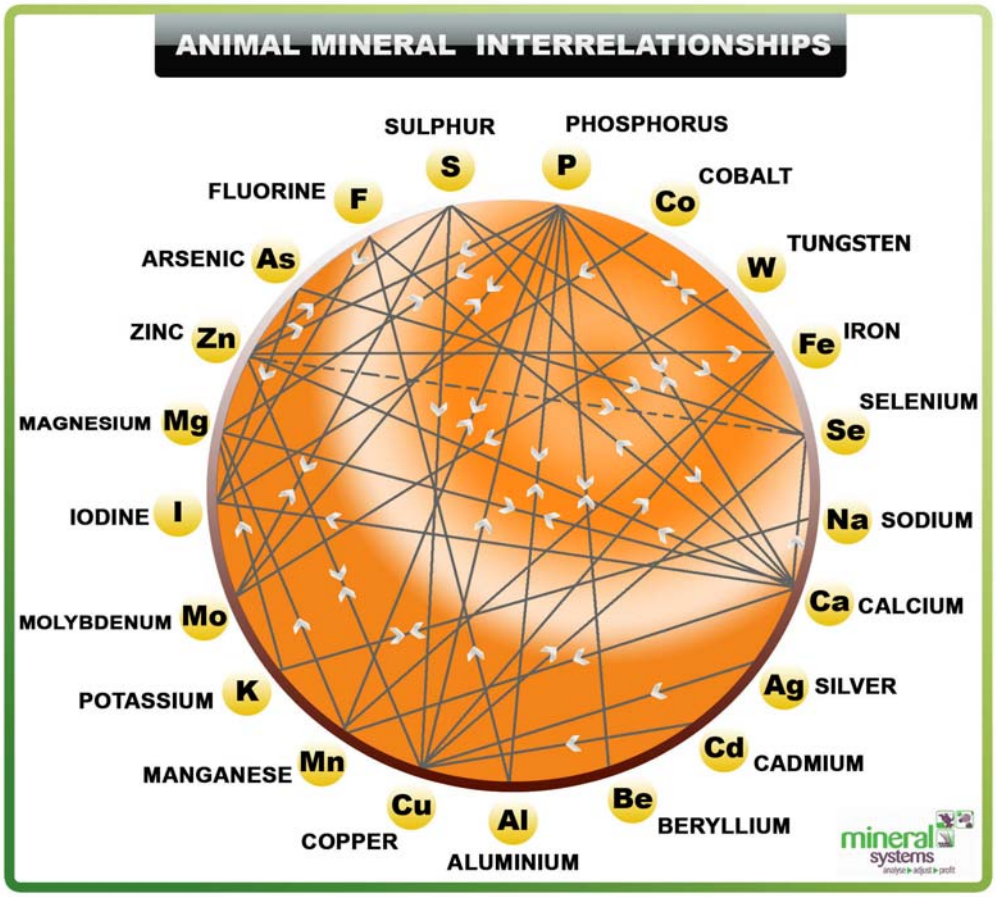
- A smaller number of physicians follow the method of interpretation of Dr. Paul Eck, a pioneer in hair analysis interpretation. Dr. Watts worked for Dr. Eck, but has altered Dr. Eck's method so that it is hardly recognizable.

What can a mineral analysis reveal?

Analyzing hair tissue for chemical elements is quite different from testing blood, urine or feces, although all have great value in the right situation. Hair mineral analysis can reveal the following:

1. The metabolic type. This is an important fact of body chemistry. It is most helpful to understand dozens of symptoms, and to guide the dietary and supplement recommendations. It also helps to understand many emotional and mental symptoms as well.
2. Energy and vitality level. Energy is a common denominator of health. This means that if one's energy is low, hundreds of symptoms can occur. Restoring one's biochemical or adaptive energy is a key to healing. This is one of the most basic healing principles. Hair analysis is fabulous to evaluate the reasons for lowered energy and vitality, and guiding exactly how to increase real energy production rather than just stimulate energy, as most healing program do.
3. Gland and organ insights. Hair testing provides indirect and direct indicators for the cellular effect of the thyroid and adrenal hormones, and at times the ovarian hormones as well. It can also be used indirectly to assess the activity of the liver, kidneys, stomach, intestines and perhaps other organs as well.
4. Assessing carbohydrate tolerance. Hair analysis can be used to quickly screen for hypoglycemia and, at times, diabetes, although a glucose tolerance test (GTT) should be done if one suspects diabetes. Hair testing can, however, usually guide a practitioner to correct Type 2 diabetes and some Type 1 diabetes without the need for most drugs. Mineral imbalances and chronic infections are often involved with these conditions.
5. Toxic metal assessment. No method of testing can detect all the toxic metals in the body. Hair analysis is sometimes helpful, however, to assess the levels of the major toxic metals in the body.
6. Reducing guesswork in recommending diets, nutritional supplementation and detoxification methods. Many physicians are becoming aware of natural healing methods, but apply them in a haphazard manner that can make matters much worse.
7. Trends or tendencies for over 60 common health conditions. This is a great benefit because it enables a practitioner to predict health problems that may arise in the future, and thus help prevent their occurrence. This is much less costly and more effective than waiting until a disease such as cancer or heart disease occurs. This fact about hair mineral testing alone would save billions of dollars if it were used widely. It is a wise and easy way to screen for tendencies for diabetes, heart disease, chronic fatigue, cancer and many other serious conditions.

8. Monitoring Progress. Hair analysis can help monitor a person's healing progress. Symptom changes alone are often not a good way to know if a person is progressing on a healing program. However, the hair test will often detect subtle changes in body chemistry, which is another wonderful benefit of this test.
9. Stress patterns. A properly performed hair mineral analysis is superb to assess the stage of stress and some 20 to 30 stress response patterns of the human body. This type of analysis and interpretation is based on the stress theory of disease, first put forth by Hans Selye, MD some 60 years ago and still not well accepted by the medical profession. However, it is most useful to help reverse many types of pathology that do not respond well to other methods of care, either traditional medical care or holistic health care.
10. Autonomic nervous system assessment. A properly performed hair mineral test can assess many aspects of the functioning of the autonomic nervous system. This is critical imbalance today in thousands of people and leads to hundreds of symptoms from digestive disturbance and inability to eliminate toxic metals, to sleep disturbances, blood sugar problems and even cancers.
11. Psychological/emotional illness assessment. Among the most interesting use of the hair mineral analysis is the assessment of causes for mental and emotional symptoms such as depression, anxiety, panic attacks, ADD, ADHD, autism, schizophrenia, dementia, violence, bipolar disorder and several others. This is a fascinating area in which hair analysis has a treat contribution to make to medical and psychiatric science.
12. Other. Other assessments are possible if one understands a hair analysis thoroughly. Some of these include movement patterns and other more subtle aspects of biochemistry, physiology, and possibly more esoteric sciences such as pleomorphism, biological transmutation of the elements and others.



How are the readings reported?

The mineral values are usually reported in three ways:

1. Milligrams per 100 grams, often written as mg%.

2. Micrograms per gram or ug/g. This gives numbers that are 10 times higher than milligrams per hundred grams or mg%. To convert the reading to mg%, simply move the decimal point one space to the left. For example, if calcium is reported as 1210 ug/g, it is the same as 121 mg%

3. Parts per million or ppm. The readings are the same as ug/g.

What does the hair analysis measure?

The minerals listed above are the most important chemical elements used in the body. They are locked into the hair as it grows. One can assess:

- Levels of all the 20-40 or more minerals.
- Ratios between the minerals, of which there are four major ones and some 50-100 minor ones. This adds significant complexity and a great deal more information.

- Simple patterns consisting of combinations of the levels and/or ratios. It is easy for the practitioner to use some 20-25 of these, but there are probably more.
- Complex patterns consisting of combinations of simple patterns and various levels and ratios. Again, it is easy for the average practitioner to use about 10 of these even though they can become very complex, at times.
- Changes over time of all these, and the rate of change in all parameters. This part of interpreting the test requires retests and comparisons between tests over time when a person has followed a nutritional balancing program.
- Physical or biochemical interpretation of all the above.
- Psychological or personality interpretation of the above.
- The way the body is responding to stress in its environment.
- Other levels of interpretation that have to do with movement patterns, for example. This means how a person moves or reacts to his biochemistry when in a particular pattern. This is actually very helpful information for both doctor and client.

The test is also useful to monitor overall health and changes in health status, no matter what therapy is being employed by the practitioner. The reason for this is that hair mineral analysis is not a therapeutic intervention, but simply a way to monitor the body at a very deep cellular level, and at even deeper levels, at times.

Documentation

Mineral analysis by mass spectroscopy and related methods is a standard testing procedure used at laboratories and universities throughout the world. Hair mineral testing on human and animal populations has been carried out for over 80 years.

Well over two million analyses have been performed. Several thousand papers and other research have been published on this method of biological monitoring. About 300 of these are listed by clicking on hair analysis references.

Regarding toxic metals, the United States Environmental Protection Agency published a 300-page study in August 1979. They reviewed over 400 journal articles on hair testing. The authors concluded that hair is a "meaningful and representative tissue for biological monitoring for most of the toxic metals".

Challenges to the validity of hair analysis

Several studies critical of hair analysis have been published. Most criticism stems from two studies published in the Journal of the American Medical Association. The first was published in August 1985, 254(8)1041-1045.

In this study, standard hair analysis protocol was ignored in three ways, any one of which would be enough to discredit the entire study:

1. A few long pieces of his daughter's hair were used. This is not the correct way to do the test. One must use small one-inch samples cut close to the scalp. The ends of long hair are more subject to contamination and should never be used.

2. Samples were washed under the kitchen tap before being sent to the laboratory. This is also a violation of standard hair sampling protocol. Tap water is often rich in minerals. Hair samples should never be washed in this manner.

3. Hair samples were mixed together by hand. Here is another violation of standard protocol. It is difficult or impossible to obtain a homogenous sample this way because hair tends to stick together. Hair should have been powdered first and then mixed together, or at least cut into tiny parts before mixing.

Other flaws in this study were:

The author had a clear conflict of interest. He was, and may still be, the director of Quackwatch, a medical industry-funded group that specializes in deriding natural, alternative, complementary and holistic methods of healing. This author of the study operates over 30 website that he uses to denigrate holistic healing methods under various titles and pseudonyms.

Referencing for the study was almost nonexistent. For example, the author completely ignored over 400 studies that had been done on hair analysis and reported upon by the United States Environmental Protection Agency only 6 years before. Obviously, the author was either extremely ignorant about hair analysis research or did not care what the medical community really knew about it.

The author admitted in the study that he had no professional experience with hair analysis whatsoever. One must wonder why he was picked to author this study.

The 2001 JAMA Hair analysis study

Another study appeared in JAMA, #285, #1, Jan.3, 2001 that claimed to "revisit" the earlier one. Six hair samples were cut from one person and sent to six laboratories for analysis. Flaws in this study include:

1. An illegally operating, unlicensed mineral testing laboratory was included in the study. This lab reported the worst results, and was the basis for the authors conclusion that hair mineral analysis is unreliable. This is so bizarre it is once again difficult to fathom. Would JAMA publish a study of brain surgery procedures and use an illegally-operating hospital or a bogus surgeon? I doubt it.

Plenty of other hair testing labs could have been used, but the authors somehow found one that had lost its license. This makes little sense, unless one wishes to discredit the field of hair analysis.

2. The “study” involved only one patient. I learned in medical school that a report involving only one or two people is “anecdotal”, and not a valid study. It is shocking that the Journal of the American Medical Association would accept such a report and print it. It is also a poor reflection on the authors that they would draw any conclusions at all from this anecdotal “study”.

3. Rather than compare the raw data, the authors compared whether readings were reported as high, normal or low. This is not a measure of the reliability of hair analysis, as they claim. This is comparing the reference ranges of various laboratories, which is another issue altogether.

4. The authors demonstrated clear bias and ignorance of hair analysis. They referred to the 1985 JAMA study, stating, “we decided to update Barrett’s results”. This implies they were unaware or unconcerned with all the flaws in the earlier study.

5. Very poor referencing again. Very few studies of hair analysis were mentioned, and once again, the authors ignored hundreds of favorable studies of hair analysis.

6. Ignoring their own findings. In this anecdotal report, the two laboratories that do not wash the hair at the lab, ARL and TEI, provided identical results in 6 of 9 trace minerals and extremely close results on the other three. In other words, in the only valid comparison of hair analysis laboratories, results indicated the exact opposite conclusion than that drawn by the authors. This fact was completely overlooked and not reported by the authors in their discussion or conclusion. Essentially, the anecdotal report indicated that when the hair is not washed at the lab, the results are astoundingly reliable and accurate, but this fact was ignored and the authors conclusion was the exact opposite of this truth.

Hair analysis expose on ‘NIGHTLINE’

A 'Nightline' television show discussed hair analysis in a widely watched program. In this “expose”, hair from a dog was sent to a commercial hair analysis laboratory. The perpetrators of this scam from 'Nightline' led the laboratory to believe it was a human hair sample. They did not tell the laboratory it was from a dog. Identifying the species from which hair is sampled is the standard and an obvious procedure.

When results came back, they were very odd because the normal mineral values for a dog are very different than for humans. The television host claimed that this was a healthy dog and that such odd results proved that hair analysis is a fraud.

Of course, if one sent a dog's blood to a blood laboratory and did not tell the laboratory it belonged to a dog, the exact same thing would happen. This, of course, was not pointed out in the Nightline piece.

The June 12-13, 2001 CDC Report on hair analysis

Another shameful government pronouncement on hair testing took place in 2001 at the Centers for Disease Control and Prevention. A panel was assembled to evaluate “the state of the art of hair analysis”. It involved seven “experts” in toxicology and other fields and 50 public observers.

The experts reviewed 7 studies of hair analysis to prepare for the meeting. In addition, another 25 studies were cited during or after the meeting. Based on this “review”, the panel concluded that hair analysis is not effective or reliable as a method of biological monitoring for toxic metals, with the exception of methyl mercury. Flaws in this report include:

- Extreme lack of references. A review of only 32 studies of hair analysis should have disqualified this panel right away. In addition, of the 32 papers, one was a CDC paper on toxic chemicals, one was a report on the anatomy and physiology of hair, and one was an article about controlling hair growth. Another concerned Napoleon Bonaparte’s exposure to arsenic in 1816, while another was about regeneration and rate of hair growth in men. One was also the 1989 recommended dietary allowances. Totally ignored were literally hundreds of studies, many of which are in the reference section of this text.
- Overlooking their own research. There was no mention or citation of the government’s own 300-page review of over 400 studies of hair analysis conducted in August of 1979. This was a real review that could have been updated by the CDC, had they cared to do so. The earlier review concluded that hair testing was “meaningful and representative for biological monitoring for the major toxic metals”.
- Unqualified experts. The 7-member panel of ‘hair mineral analysis experts’ included 1) a professor of emergency medicine, 2) the president of an internal medicine consulting service, and 3) an employee in the Department of Health Education and Promotion at the ATSDR. Also among the experts was Dr. Seidel, one of the authors of the second JAMA study described above. This might be seen as obvious bias, since she was the lead author on a very negative study of hair analysis. The reference for this panel discussion is http://www.atsdr.cdc.gov/HAC/hair_analysis/index.html.

Preparing the hair for testing

Accurate results depend on cutting hair samples correctly. Here are basic rules for sampling the hair.

1. Cut the sample from anywhere on the head. The nape of the neck is excellent but other areas are fine as well. Hair can be cut from other parts of the body, although these are not as accurate in most cases.

2. Cut the hair as close to the scalp as possible for the most recent and therefore the most accurate readings.

3. Then measure about one inch or two centimeters from where it was cut on the head. Cut off the rest of the long hair and throw it away. Using even shorter hair is excellent. The only problem is with long hair.

4. The best way is usually to cut several little samples and combine them until the paper scale tips or until you have filled a small spoon or have 125 mg of hair. (This is not a lot of hair.)

5. Hair that has been tinted, dyed, highlighted, bleached or permanent-treated may be used. If it has been bleached or permed, please wash the hair several times after the hair treatments before cutting the sample to remove the chemicals and allow the hair to grow out a little.

6.Thinning shears or even a razor may be used if the hair is short. It must be an electric razor, as we do not want the hair mixed with shaving cream or soap. If thinning shears are used on long hair, it may be hard to tell which end was cut.

7. Use a clean paper (not plastic) envelope to collect the hair. Plastic is okay, but the hair tends to stick to it and is harder to remove easily.

8. The sample must be sent to a licensed clinical laboratory for analysis. The best labs are Analytical Research Labs in Phoenix, Arizona (our first choice) or Trace Elements, Inc. in Addison, Texas. Do not use a lab that washes the hair, which is all the others we know of. These labs are fine for toxic metals only. They are not good at all, however, in terms of our type of interpretation of the electrolyte readings, which are notably inaccurate due to the washing procedure.

How is the hair analyzed?

The procedure described here applies to the two laboratories mentioned above - at times less rigorous procedures may be used at other hair testing laboratories.

1. Hair samples arriving at the laboratory are first cut into small pieces with surgical scissors.

2. A precisely weighed amount of hair is digested overnight in nitric and perchloric acid.

3.The following day the sample is rehydrated and placed in the measuring instrument to be assessed for minerals.

The most common measuring instrument today is an ICP-mass spectrometer. This is a highly sophisticated hybrid, computer-controlled machine costing several hundred thousand dollars. It is not a “home or office unit”. Any doctor

who runs this test in his office is not using the same equipment and results may not be as accurate.

Essentially, the dissolved sample is burned at a high temperature. Each mineral gives off a characteristic spectrum or frequencies of light, which is picked up by sensitive detectors in the measuring instrument. Calibration and precise control of the flame temperature are essential to obtain accurate readings.

Licensing. In America, hair mineral analysis laboratories are inspected annually by the U.S. Department of Health and Human Services, Health Care Financing Administration, Division of Health Standards and Quality. An operating license is issued only if personnel and procedures meet rigorous standards.

Quality Control. Most reputable labs run control samples and blank samples at the beginning, middle and end of every batch. Also, small amount of hair is set aside and any readings that are far out of range are retested automatically at no extra charge. This is not done at most laboratories.

Hair tissue mineral analysis is not something that can be done in an office or at home. If someone offers a test that is done at the office, it is not the same test. Only about eight or nine laboratories offer commercial hair tissue mineral analysis in America and a few exist overseas. All other laboratories send hair samples to one of the few labs that have the correct equipment and licensing to perform the test.

Washng the hair at the laboratory

We have already touched on this topic above, but as it is an important topic, let us discuss it again here in a little more detail. The danger of environmental contamination has prompted many mineral testing laboratories to wash the hair before analyzing it. However, studies indicate this is far worse than the occasional contamination due to an environmental agent. These include the following studies:

- Leroy, R. (J Ortho Med., 1986;1(2)).
- Seidel, et al. (JAMA, 2001, 285, #1). The authors compared hair test results from about six labs. The results of the two laboratories that do not wash the hair samples showed excellent correlation, unlike some of the others. One must obtain the actual test numbers to realize this, as it is not mentioned in the study.
- Assarian, GS and Oberleas, D., (Clin Chem., 1977;23(9):1771-1772).

These studies showed that washing the hair at the laboratory erratically and unpredictably removes calcium, sodium and potassium. Zinc, magnesium, nickel and most other elements are also affected by washing. Thus, we recommend only using a laboratory that does not wash the hair at the laboratory.

At this time, there are two labs that do not wash the hair in the United States. These are Analytical Research Laboratories in Phoenix, Arizona, the lab I use, or Trace Elements, Inc. The second laboratory is owned by a former employee of Analytical Research Labs, Prof. Watts. He understands why the hair must not be tampered with before it is analyzed at the laboratory.

Those who favor washing the hair at the lab contend that any mineral that is washed out is 'exogenous' - not really part of the hair. Judging by the excellent predictability the mineral ratios provide when the hair is not washed, one is lead to conclude that the loosely bound minerals are not simply exogenous. They are part of the biopsy material.

Contamination of hair samples

Some say that hair samples are inaccurate due to hair treatments and environmental contamination. However, the two labs mentioned here find that shampoo, conditioners, rinses, hair dyes, tints, light sweating and air pollution generally do not significantly affect hair readings.

Most people wash their hair frequently. Most hair products do not contain many minerals that remain in the hair after the product is used. Therefore the test is not affected. Hair is not very porous, about 10% in men and 15% in women. Most contaminants do not remain within the hair.

However, swimming in pools can raise sodium and copper levels. Heavy sweating immediately before cutting the sample can raise sodium and potassium readings. 'Grecian Formula' and 'Youth Hair' hair dye contain lead. They will elevate the lead level (and should be avoided!).

Head & Shoulders shampoo can elevate the zinc level. Selsun Blue shampoo can elevate the selenium level. These contaminants are usually easy to identify on a hair test because the readings are heavily skewed. Asking the patient what products are on their hair will usually be sufficient to rule out abnormal readings due to hair products.

Showering may wash out a small percentage of water-soluble minerals. However, minerals from the sweat or oil glands appear to re-establish an equilibrium on the hair within a half-hour after washing. Of course, this re-equilibration cannot occur if the hair is washed after it is cut from the head at a laboratory.

Bleach or other harsh chemicals used in permanents will have some effect on hair readings. If possible, take a hair sample before having a permanent or bleaching. After a beauty parlor permanent or bleaching treatment, it is best to let the hair grow out for several weeks.

Second best is to wash the hair 4-5 times after these treatments before having a hair analysis. However, if a person is very ill, a sample can be taken at any time. It may not be perfectly accurate, but will provide enough information to begin a corrective program.

Can a hair analysis help design nutrition programmes?

Some authors criticize hair mineral testing when it is used to recommend nutritional supplements or even foods for improving one's health. In particular, vitamins may seem difficult to recommend because the test only detects mineral levels. Let me explain how this is done, however, with a simple example.

It is known that certain vitamins, such as vitamin C, can be used to help remove toxic metals. Thus a practitioner may recommend supplementary vitamin C if a hair analysis reveals excessive toxic metals. There are many other ways the test can be used to recommend herbs, vitamins and other nutritional products.

SUMMARY

Hair tissue mineral analysis has come about only in the past 40 years or so. It is widely used in biological monitoring of animal species throughout the world and is being used more and more for human metabolic assessment as well. When understood properly, it offers great potential to improve human and animal health at the deepest levels. It can also be used preventively and for prediction of illness, two benefits that are sorely needed in today's world.

In the next lesson we will be looking at how we interpret hair analysis.

This course contains many articles on various details of hair mineral testing so that the practitioner can really come to terms with the various ways that the test should be interpreted. A short list of references and resources are as follows:

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