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Advancing the Science of Wellness
Rocky Mountain Analytical

Date of Collection: 2-Mar-1953
Sample Received: 25-Sep-2017
Reported Date: 29-Sep-2017
Sample Type: Scalp hair

Hair Element Analysis — Accession #: 581824

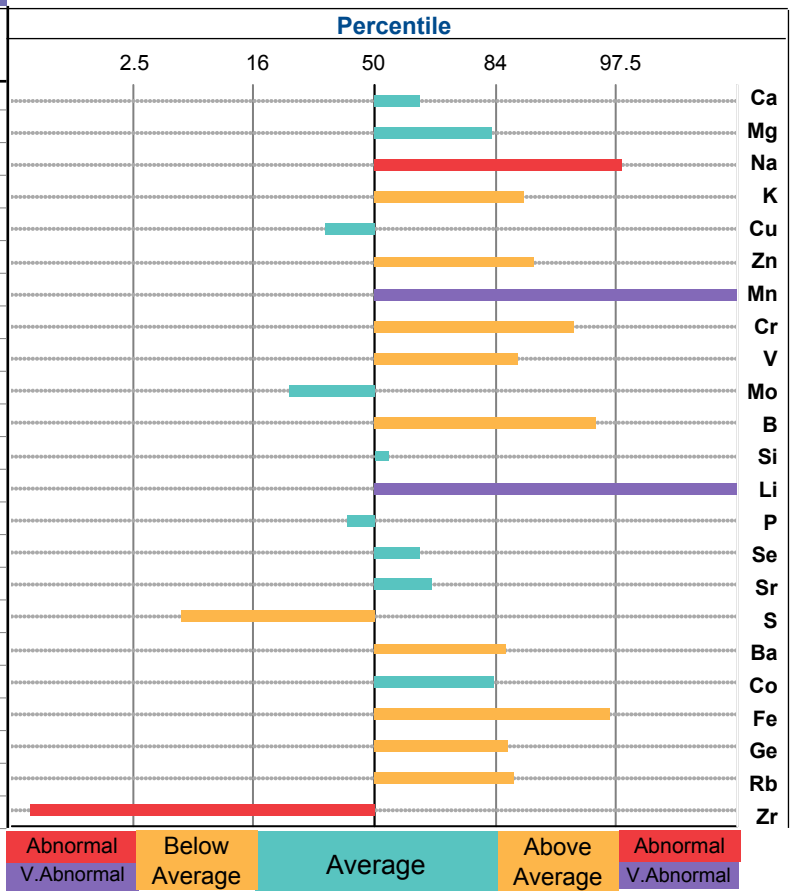
Provider:
West Coast Naturopahtic Medicine
Douglas Kuramoto ND
525 Pioneer Cres
Parkville, BC V9P 1V1
Phone: 250-954-1955
Fax: 250-586-5051

Patient:
Sandra Finley
203 222 Second Ave W
Qualicum Beach, BC V9K 0A4
Phone: 250-594-9898

Gender : F
Date of Birth : 01-Apr-1949
Age: 3

Essential / Non-Toxic Elements

Essential Elements	Results ug/g	Reference Range ug/g
Calcium	570	140 - 1,000
Magnesium	97	14 - 100
Sodium	160	2.9 - 40
Potassium	37	3.1 - 28
Copper	14	11 - 27
Zinc	240	110 - 210
Manganese	2.3	0.15 - 0.50
Chromium	0.49	0.13 - 0.35
Vanadium	0.11	0.019 - 0.090
Molybdenum	0.052	0.045 - 0.12
Boron	7.1	0.40 - 3.0
Silicon	370	270 - 470
Lithium	0.14	0.0056 - 0.011
Phosphorus	140	120 - 190
Selenium	1.2	0.72 - 1.6
Strontium	1.6	0.22 - 3.1
Sulfur	45,000	47,000 - 53,000
Barium	2.5	0.43 - 2.3
Cobalt	0.036	0.0073 - 0.036
Iron	29	14 - 23
Germanium	0.013	0.0028 - 0.012
Rubidium	0.051	0.0074 - 0.044
Zirconium	0.061	0.32 - 1.9



** Result lies below detection limit (DL is at right end of bar)*

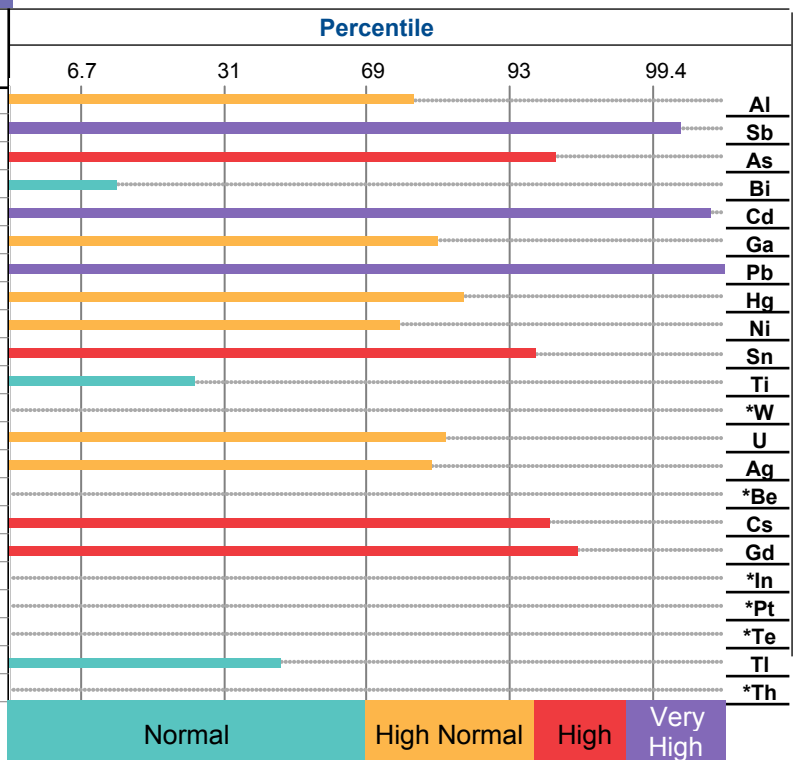
NOTE: Our interpretation follows the system developed by Andrew Hall Cutler PhD, which requires consideration of the overall distribution pattern for essential elements as a first step in the interpretation of the results. If the essential element distribution pattern is statistically normal, then both toxic and essential element results can usually be taken at face value. If the essential elements results exhibit a statistically improbable distribution pattern, this suggests heavy metal toxicity or some other interfering process. The interpretation comments starting on page 3 state whether the essential element graph above fits a statistically normal or statistically unlikely distribution pattern.

Hair Elements Analysis Report

Accession #: 581824

Toxic / Potentially Toxic Elements

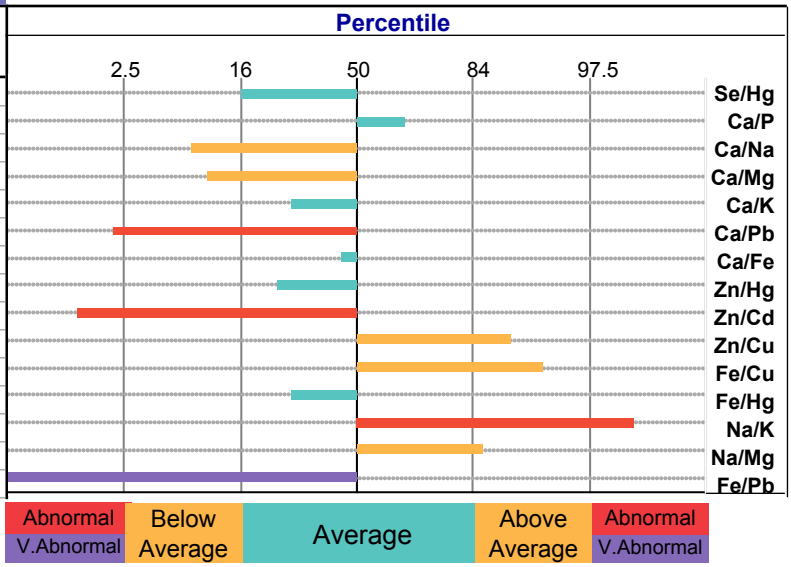
Toxic Elements	Results ug/g	Reference Range ug/g
Aluminum	19	<27
Antimony	0.50	<0.23
Arsenic	0.32	<0.28
Bismuth	0.0070	<3.3
Cadmium	0.94	<0.26
Gallium	0.0080	<0.012
Lead	17	<3.3
Mercury	0.40	<0.66
Nickel	0.55	<1.9
Tin	2.0	<2.0
Titanium	1.3	<4.4
Tungsten	< 0.010	<0.010
Uranium	0.069	<0.14
Silver	0.32	<1.0
Beryllium	< 0.0070	<0.0055
Cesium	0.0020	<0.0018
Gadolinium	0.0040	<0.0030
Indium	< 0.00030	<0.00040
Platinum	< 0.0040	<0.0051
Tellurium	< 0.0060	<0.0060
Thallium	0.0010	<0.0050
Thorium	< 0.020	<0.0060



** Result lies below detection limit*

Element Ratios

Ratios	Results	Reference
Se/Hg	3.1	3.1 - 26
Ca/P	4.0	0.92 - 7.4
Ca/Na	3.6	7.1 - 180
Ca/Mg	5.8	6.7 - 18
Ca/K	15	7.1 - 240
Ca/Pb	32	150 - 2,500
Ca/Fe	19	8.5 - 56
Zn/Hg	600	440 - 3,100
Zn/Cd	250	1,100 - 9,400
Zn/Cu	17	3.3 - 13
Fe/Cu	2.1	0.31 - 1.3
Fe/Hg	74	45 - 410
Na/K	4.3	0.56 - 1.9
Na/Mg	1.6	0.059 - 1.4
Fe/Pb	1.7	13 - 65



DISCLAIMER MANDATED BY THE COLLEGE OF PHYSICIANS AND SURGEONS OF ALBERTA
This hair analysis method has been reviewed and accepted by the Laboratory Accreditation Committee of the College of Physicians and Surgeons of Alberta. The College considers hair element analysis to be complementary medicine. Analysis of chemical elements in hair has been used in research but is not approved for diagnosis of toxicity or deficiency states. Rocky Mountain Analytical does not diagnose or make treatment recommendations. Data is provided for research and educational purposes only.

DOES THE LENGTH OF THE HAIR STRANDS MATTER?
Hair grows about 1 cM per month. If a snapshot of what has gone on for the patient in the month or so immediately prior to sampling is desired, it is necessary to only sample the hair closest to the scalp. If we receive hair samples longer than 1 cM, please be aware that the interpretation will reflect average conditions over an amount of time proportional to the length of the hair! For example, a hair sample consisting of 6 cM strands will give results averaged over roughly 6 months prior to sampling.

I TREAT MY HAIR (DYE,PERM, BLEACH), BUT DIDN'T NOTE THIS ON THE REQUISITION. DOES THIS MATTER?
Patients whose hair is coloured, permed or bleached are advised to wait at least four to six weeks after their last hair treatment, and to only submit the first 1 cM of hair closest to the scalp (hair grows about 1 cM per month). This ensures that untreated hair is being analyzed. Dyed, bleached or permed hair may give a false interpretation supporting element toxicity.

STATISTICALLY UNLIKELY PATTERN FOR DISTRIBUTION OF ESSENTIAL ELEMENTS
The essential element distribution pattern is abnormal/statistically unlikely for one or more reasons and this could be indicative of altered mechanisms of transport of elements into hair, as outlined by Dr. Andrew Hall Cutler, in his book: Hair Test Interpretation: Finding Hidden Toxicities. Dr. Cutler formalized and greatly expanded the approach espoused by Dr. Jonathan Wright of the Tahoma Clinic.

Basically, Dr. Cutler applied a statistical model to predict the distribution or "character" of the results for the essential elements. He devised "counting rules" detecting patterns which had less than a 5% probability of occurring by chance. These patterns have to do with the symmetry of the distribution (bars going left vs bars going right), the overall number of green bars, and the overall number of red and purple bars (again for the essential elements).

In any event, he postulated that when the essential element distribution was abnormal according to his rules, then the result for any given element (essential or toxic) might not be reflective of body burden, or in general might not have the same meaning as it would when essential element distribution is normal, and this might reflect a toxic influence of certain elements such as mercury, lead, cadmium in isolation or in synergy. This was based on studying thousands of hair element profiles. He also noted that specific abnormal patterns of transport were common within families, and probably indicated a genetic tendency in some cases.

MORE THAN 3 RED AND OR PURPLE BARS FOR ESSENTIAL ELEMENTS
Here there are at least four red and/or purple bars and/or very long gray bars for the Essential elements. The probability of this happening by chance is less than 5%, according to the statistical model constructed by Dr. Cutler. This may be a manifestation of the accumulation of one or more toxic elements.

"SCATTERED" DISTRIBUTION OF ESSENTIAL ELEMENTS
Here there are fewer than 12 green bars. The probability of this happening by chance is less than 5%, according to the statistical model constructed by Dr. Cutler. This may be a manifestation of the accumulation of one or more toxic elements.

ESSENTIAL ELEMENTS ARE RIGHT-SHIFTED
The essential elements are exhibiting a "right shift" with 18 or more essential elements whose results lie above their mean (18 or more green, red, yellow or purple bars going right). One interpretation of this finding is that the body may be "dumping" elements into the hair over and above what would normally be present. It is more commonly seen in children. Some practitioners experienced with hair testing are of the opinion that this is due to some toxic influence, such as a heavy metal interfering with the element transport mechanisms into hair. It may also be a genetic tendency. A right-shifted essential element profile should not be interpreted to mean that there is an excess body burden of multiple essential elements. Rather, it is a symptom of a global perturbation of element transport.

SOME ELEMENTS WITH YELLOW BARS HAVE NO ASSOCIATED COMMENT
If no comment appears for any given essential element that has a yellow bar (above or below the mean), it is usually not an oversight. In most cases it means that the finding is not clinically significant.

LITHIUM MARKEDLY ELEVATED (PURPLE BAR POINTING RIGHT)
When the essential element distribution pattern is abnormal, as is the case here, it is not known to what extent hair lithium is reflective of body stores. Nevertheless, in the face of a purple bar pointing right for lithium (markedly high lithium level) it is probably worth mentioning that elevated bodily levels of lithium may interfere with thyroid function (leading to signs and symptoms of hypothyroidism) and cardiac rhythm. Lithium is commonly used as a medication to treat psychiatric disorders and also as a nutritional supplement.

MAGNESIUM BODY STORES IN THE FACE OF AN ABNORMAL DISTRIBUTION PATTERN FOR ESSENTIAL ELEMENTS
Practitioners familiar with the interpretation of hair testing generally agree that if element transport is abnormal, tissue stores of magnesium may be low, regardless of the hair test result. In other words, a normal magnesium result wouldn't necessarily rule out a magnesium deficiency. Treatment decisions would, of course, have to be left to the discretion of the practitioner familiar with this patient's case.

MANGANESE MARKEDLY ELEVATED (PURPLE BAR POINTING RIGHT)
Even though element transport is abnormal, a markedly elevated manganese level should probably be taken as an indication of excess exposure to manganese. Elevated manganese can be seen in association with excessive alcohol consumption. Some dark hair dyes contain manganese, and this will result in a falsely elevated level. Foods high in manganese include avocados, egg yolks, wheat germ and bran, oats and pineapple. Manganese is sometimes consumed in the form of potassium permanganate, but this is more likely to cause acute toxicity. Manganese can be neurotoxic in chronic excess, producing a clinical picture often mistaken for Parkinson's Disease or Multiple Sclerosis. Uptake of iodine by the thyroid gland is impaired by excess manganese. Brain levels of serotonin are reduced when manganese is in excess, resulting in depression and anxiety. A purple bar for manganese should not be dismissed unless the clinician is satisfied that the clinical presentation is not suggestive of manganese toxicity.

RUBIDIUM AND POTASSIUM BOTH HIGH
Rubidium is an alkali metal, in the same column of the periodic table as potassium. Hence rubidium is expected to behave the same as potassium: hair rubidium levels are not expected to reflect body stores of rubidium, and when hair potassium is markedly high or low, rubidium is expected to deviate in the same direction, and to roughly the same extent as potassium.

SULPHUR BELOW NORMAL (YELLOW, RED OR PURPLE BAR POINTING LEFT)
The sulphur level in hair is not reflective of the status of sulphur in other parts of the body, whether or not element transport is normal and orderly. Low sulphur hair tends to be brittle and fragile. Deficiencies of B vitamins, copper and iodine are thought to lead to a low hair sulphur content. Some authorities think that low sulphur can be associated with a high body burden of mercury. Sulphur content in hair does vary amongst people of different ethnicities, i.e. some groups of people have less sulphur in their hair than others.

ZINC BODY STORES IN THE FACE OF AN ABNORMAL DISTRIBUTION PATTERN FOR ESSENTIAL ELEMENTS

Practitioners familiar with the interpretation of hair testing generally agree that if element transport is abnormal, tissue stores of zinc may be low, regardless of the hair test result. In other words, a normal zinc result wouldn't necessarily rule out a zinc deficiency when the distribution pattern of essential elements is abnormal. Oysters contain more zinc than any other food. Crab, lobster, beef, pork and lamb are also high in zinc. Other good sources of zinc include sesame and pumpkin seeds, chickpeas (garbanzo beans). Vegetarians are often deficient in zinc, as are small children and the elderly. Treatment decisions would, of course, have to be left to the discretion of the practitioner familiar with this patient's case.

ZIRCONIUM LOW (RED OR PURPLE BAR POINTING LEFT)

Zirconium, although included in the list of essential elements, probably has no essential functions in the human body. There is no clinical significance attached to a low zirconium result with a red or purple bar, especially when the distribution pattern of essential elements is abnormal, as is the case here.

YELLOW OR RED BARS FOR TOXIC/POTENTIALLY TOXIC ELEMENTS

For some of the elements normally present in hair at very low levels, only the upper part of the statistical distribution could be accurately determined. It was possible to accurately determine the 95th percentile threshold for all elements (i.e. that concentration below which 95% of the results fall). By convention, reference ranges are usually set at the 95th percentile, so we are always able to determine whether an element is within its reference range. When a toxic/potentially toxic element has a yellow or red bar, this does not necessarily mean that this is a worrisome result; it only means that the result lies toward the high end of the observed range of values in clinically normal individuals.

ELEMENTS FOR WHICH NO BAR APPEARS

If no bar is displayed for a toxic element, it means that the measured result is below the detection limit for that element. The result is then prefaced with a "<" sign.

POSSIBLE EFFECT ON TOXIC ELEMENTS WHEN ESSENTIAL ELEMENTS ARE RIGHT-SHIFTED

As noted above, the essential elements are exhibiting a "right shift" with 18 or more essential elements whose results lie above their mean (18 or more green, red, yellow or purple bars going right). This same tendency may also be reflected in the toxic elements, i.e. some of the toxic elements may be thrown into or above the yellow zone and may not be representing body burden accurately; levels in hair may be "overstating" what might be present in the blood and other tissues.

THE INTERPRETATION OF RESULTS FOR SOME ELEMENTS MAY BE EQUIVOCAL

When the distribution pattern of essential elements is statistically unlikely, as is the case here, the hair levels of one or more of the elements aluminum, antimony, nickel, tin, titanium are often elevated well above the levels which are actually present in other body tissues.

SILVER HIGHER THAN AVERAGE (YELLOW BAR FOR SILVER)

When element transport is normal, the hair silver level is believed to accurately reflect body stores of silver. Colloidal silver is freely available as a nutritional supplement and it is possible to accumulate significant amounts of silver in hair through ingestion of colloidal silver. Elevated hair silver can reflect short-course higher dosing, or long term lower dosing. Note that silver can cause emotional instability, impatience, brain fog and binocular vision problems. Severe silver accumulation imparts a bluish-gray tinge to the skin. Note that when essential element transport is abnormal, the hair silver level may not give an accurate picture of bodily stores of silver.

ALUMINUM ABOVE NORMAL RANGE (YELLOW, RED OR PURPLE BAR)
Aluminum is above normal. The hair aluminum level is believed to reflect body burden, even if transport of elements is abnormal. Aluminum compounds are used in water treatment plants, to clarify the water and to introduce fluoride. Baking powder may contain aluminum, and foods cooked in aluminum cookware (uncoated) may absorb aluminum, depending on the acidity of the food being cooked. Processed cheese is high in aluminum. Most adults are exposed to aluminum due to use of aluminum-containing antiperspirants and use of antacids. Children absorb aluminum more readily than adults and are more sensitive to toxicity. Aluminum can be neurotoxic and has been implicated in dementia. Elevated aluminum impairs nitrogen metabolism and increases serum ammonia. Most aluminum is excreted in urine, so elevated hair aluminum may be seen in renal disease. Significantly elevated aluminum should prompt a search for and elimination of sources of exposure. A purple bar indicates a markedly elevated level whereas a red bar indicates a result at the high end of normal.

ARSENIC ABOVE NORMAL RANGE (YELLOW, RED OR PURPLE BAR)
Hair arsenic is thought to accurately reflect body burden. It is relatively easy to be exposed to arsenic as it was widely used in the past as a pesticide/rodenticide, and in some areas, the groundwater has naturally high levels of arsenic. Dust from burning of coal contains arsenic; therefore arsenic is widely dispersed in the environment. Arsenic can be high in crustaceans and fish living in contaminated water, also in fruits and vegetables grown in contaminated areas. Commercially-raised pigs and poultry are given arsenic-containing feed additives (e.g. roxarsone), and the element may concentrate in their flesh, especially the liver. Rice is notorious for being contaminated with arsenic; rice pablum is an easily overlooked potential source of exposure. (Arsenic in rice: I. Estimating normal levels of total arsenic in rice grain. Zavala YJ, Duxbury JM. Environ Sci Technol. 2008;42(10):3856-60.) Pressure-treated lumber used for fencing, playground structures and deck construction may have been treated with an arsenic-containing wood preservative (chromated copper arsenate). Running barefoot or climbing on this type of treated wood can lead to exposure (Arsenic on the hands of children after playing in playgrounds. Kwon E, et al. Environ Health Perspect. 2004. ;112:1375-1380.) Maternal-fetal transfer of arsenic also takes place. Arsenic toxicity can result in peripheral neuropathy, GI complaints (pain, nausea, diarrhea), headaches, fatigue, anemia, poor tolerance of carbohydrates, and personality changes (fear and anxiety). Chronic arsenic exposure may result in impaired cognitive development in children. With all that being said, bear in mind that our reference ranges are quite conservative. A yellow or red bar does not necessarily imply arsenic toxicity, but merely indicates that the result in question lies toward the upper end of the distribution of results from clinically normal individuals. A purple bar warrants a careful search for sources of arsenic exposure, as well as additional testing, such as urine provocation. In the literature, the normal range for arsenic is <0.5 to 1 microgram/gm, with hair levels in individuals exposed to arsenic via soil and water lying >2 microgram/gm.

CADMIUM MARKEDLY ELEVATED (PURPLE BAR)
When element transport is abnormal, hair cadmium may not reflect body burden; however, when the cadmium result is markedly elevated (purple bar) as is the case here, it is better to assume that a deleterious amount of cadmium is accumulating. Note that smoking results in significant cadmium intake (tobacco leaves concentrate cadmium naturally from the soil). Some yellow, red and orange paint pigments may contain cadmium. Organ meats and leafy vegetables such as lettuce and spinach tend to be higher in cadmium. The cadmium content in children's jewelry imported from China may sometimes exceed 91% of the item's weight (The Associated Press, January 11, 2010). Cadmium accumulates in the kidneys and it can cause learning disabilities and cognitive problems in children. Cadmium is a competitive inhibitor of zinc and it interferes with the function of delta-9-desaturase, which is important for maintaining the proper mix of fatty acids in cell membranes. Cadmium interferes with adrenal medullary synthesis of epinephrine and also restricts the ability of the body to maintain glycogen stores and impairs fatty acid utilization. Adrenal cadmium toxicity may result in hypotension. Cadmium toxic individuals may not be able to maintain stable blood glucose levels and may be intolerant of emotional and physical stress. Chronic cadmium exposure is nephrotoxic and can result in proteinuria, as well both hypertension and hypotension. Note that exposure to welding fumes and cement dust can lead to external contamination of hair. It may be helpful to assess hair samples from other family members to sort out environmental exposure vs internal exposure. Note also that background levels of hair cadmium are in the vicinity of 0.5 mcg/g. The average individual might experience toxicity at levels five to ten times higher than this, although some individuals will undoubtedly be more sensitive.

YELLOW OR RED BAR FOR CESIUM

The extent to which hair cesium represents body stores of cesium is not known. Hair levels of the alkali metals sodium and potassium are not representative of body burden whereas hair lithium is thought to reflect body burden. The same might be true for cesium. Non-radioactive cesium (Cesium-133) is naturally present in some foods (mushrooms, nuts and seeds, meat and fish) and is also used as a nontoxic treatment for cancer. A yellow or red bar for cesium does not indicate a toxic level of cesium; it simply means that the measured level is toward the high end of the range measured in clinically normal individuals. A patient ingesting cesium chloride for cancer treatment might have a significantly elevated hair cesium level. Although it is included in the toxic/potentially toxic category, cesium-133 is not thought to be particularly toxic.

GALLIUM ABOVE NORMAL (YELLOW, RED OR PURPLE BAR)

Gallium is relatively common in the earth's crust and is naturally occurring in food; food-sourced gallium is unlikely to be toxic. Transfer of gallium to infants via breast milk has been reported. The Ga concentration in the body is estimated to be less than 0.01 mcg/g. Levels lower than this appearing in hair should probably not be considered abnormal. Higher levels would be expected in someone working with gallium in an industrial setting such as the semiconductor industry. Gallium arsenide has been studied extensively in the past, due to concerns about exposure in the semiconductor industry; toxicity of gallium arsenide may be related to the arsenic content as opposed to gallium itself. One of the mechanisms whereby gallium exerts toxicity is by competing with iron for transferrin binding sites. It may interfere with delivery of iron to cells and has therefore been used therapeutically for cancer patients, to inhibit tumour cell growth. Gallium compounds can also cause pulmonary and renal toxicity. Gallium has an affinity for bone and gallium nitrate has been used to reduce serum calcium levels in cancer patients with bone involvement. Absent industrial exposure to gallium arsenide, yellow or red zone gallium in hair should usually not be taken as an indicator of toxicity; it merely indicates that the gallium level is toward the high end of the distribution of gallium results in clinically normal individuals. A markedly high (purple bar going right) for gallium is not likely to be significant when the essential element distribution is right-shifted.

GADOLINIUM ABOVE AVERAGE OR HIGH (YELLOW OR RED BAR)

There is no consensus regarding the degree to which hair gadolinium reflects levels in other tissues. We do know that individuals who have had MRI imaging studies which employed gadolinium as a contrast medium may have elevated gadolinium levels in their hair for months after the exposure. If there is no history of gadolinium exposure via MRI, an elevated level can probably be ignored. A yellow or red bar for gadolinium does not indicate toxicity; it merely indicates that this individual's result is at the high end of the range observed in clinically normal individuals.

MATERNAL MERCURY LEVEL IN PREGNANCY

The authors of an October 2010 article on fish consumption in pregnancy, and fetal toxicity from methylmercury conducted a meta-analysis of the literature and concluded that in pregnant women, the risk of adverse neurological impact on the fetus was significant when hair mercury level in the mother exceeded 0.3 mcg/g (Koren G, Bend J. Fish consumption in pregnancy and fetal risks of methymercury toxicity. Can Fam Phys 2010;56:1001-1002.

MERCURY HIGHER THAN AVERAGE (YELLOW BAR)

Mercury is elevated in the face of a statistically unlikely essential element distribution pattern. Retention of mercury in the body may actually be the cause of the abnormal pattern. Hence mercury may be disrupting the transport of many elements (including itself) into hair. The mercury level reported here should not be interpreted as being reflective of body burden. Sources of mercury exposure include seafood (especially larger fish toward or at the top of the food chain), allergy shots and silvery coloured dental amalgams as well as high fructose corn syrup (HFCS). The levels of mercury found in HFCS-containing products are substantially lower than those found in seafood, but children consume large (and increasing) amounts of HFCS. Note that children are more sensitive to the effects of mercury than adults. A more detailed discussion is beyond the scope of this report.

NICKEL HIGHER THAN AVERAGE (YELLOW BAR)

Nickel is higher than average (yellow bar). It is not clear whether hair nickel reflects body burden of nickel, even when element transport is normal and orderly. When essential element transport is not normal (as is the case here) nickel may be deposited into hair such that the hair level over or under-represents the actual body burden of nickel. Nickel is present in some hair dyes. Elevation of nickel and tin together may be an artifact of hair treatment.

LEAD HIGH (YELLOW, RED OR PURPLE BAR FOR LEAD)
For many of the toxic/potentially toxic elements, findings are usually not significant until the level moves well into or above the red zone. Lead is an exception, because it is relatively easy for the average person to be exposed to lead, and it is more toxic than some of the other elements. Children are more sensitive to lead than adults; levels above 1 mcg/g may cause problems with attention and activity level in children. Yellow zone (or higher) lead should not be ignored unless the clinician is satisfied that signs and symptoms of lead intoxication are absent. Note that use of lead-containing hair dye products will elevate hair lead levels significantly; systemic absorption of lead through the scalp, from use of these products is low, but lead can still be introduced systemically in these instances, via the hand-to-mouth pathway (http://www.academia.edu/20640338/Lead-based_hair_coloring_products_Too_hazardous_for_household_use).

LEAD GREATER THAN 5 PPM
Use of lead-based hair colouring agents is widespread. Hair lead levels above 3-5 mcg/g are probably due to use of hair colouring agents, in the absence of typical signs and symptoms of lead exposure. Please review all hair care products and hair treatments that this patient uses. If this patient is not using a lead-containing hair colourant, please contact the Medical Director at 403 241 4513 or 866 370 5227.

ANTIMONY MARKEDLY ELEVATED (PURPLE BAR)
Antimony is markedly elevated. Most people have some exposure to antimony through the flame-retardant treatments applied to upholstery, carpets, drapes and some clothing (in particular children's pyjamas). Antimony can also be found in PETE plastic. Antimony is also found in gunpowder; individuals who frequent firing ranges and load their ammunition often have elevated hair antimony. Therefore, it is not unusual to find antimony in the hair of people who do not have workplace exposure to antimony. When the distribution pattern of essential elements is abnormal, as is the case here, some elements build up in hair to an extent which does not reflect body burden. This is supposedly not true for antimony; the elevated level measured here should be taken to be reflective of body burden. Levels in normal individuals in the literature range up to 1 mcg/g. Our normal ranges are quite conservative in comparison. A purple bar indicates that the antimony level is quite high compared to a normal reference population, but if the level is less than 1 mcg/g it still may not be clinically significant. It will depend on the clinical situation. Chronic antimony intoxication can lead to nonspecific complaints such as fatigue, achiness, GI complaints and general malaise, as well as muscle weakness. Antimony is toxic to the liver and heart, and can cause cardiac arrhythmia and cardiomyopathy. The significance of a purple bar for antimony is best left to the practitioner involved with this patients case.

TIN ELEVATED OR MARKEDLY ELEVATED (RED OR PURPLE BAR)
Tin is elevated or markedly elevated (red or purple bar) and the distribution pattern of essential elements is statistically unlikely. Tin is one of the first elements to go high if element transport is being disrupted by mercury toxicity. Therefore a high tin level may not reflect body burden of tin.

It would still be prudent to eliminate sources of tin exposure (uncoated tin food cans, PETE plastic, pewter, solder, industrial exposure, some multivitamins and seafood).

Note that elevated tin may be seen after certain hair treatments, if care is not taken to sample untreated hair.

Marked elevation of tin in conjunction with elevation of other elements (aluminum, antimony, nickel and titanium) increases the lilkihood that the high tin result does not truly reflect body stores. Treatment to reduce body burden of mercury is often effective in reducing the hair tin level, as mercury causes the retention of tin in the body. Chronic tin exposure can be neurotoxic, affecting balance, co-ordination, memory, vision; chronic tin exposure also results in malaise, fatigue and depression.

URANIUM ABOVE NORMAL (YELLOW, RED OR PURPLE BAR)
The uranium level in hair is thought to reflect both ingestion of uranium from drinking water as well as adsorption of uranium from water used to wash hair, directly onto the hair shafts. Therefore hair uranium may be variably reflective of body burden.

Uranium is found naturally in groundwater and also in food (for example shellfish are known to concentrate uranium). Root vegetables tend to have higher amounts of uranium if exposed to uranium-containing groundwater. Groundwater levels vary widely from place to place due to local geology (water flowing through granite and some sandstone rock formations tends to be high in uranium). Elevated uranium may simply be reflective of local factors and food preferences, and hair levels can vary tremendously from person to person. Again, this may depend on frequency of hairwashing, type of shampoo, and so on.

The main concern with a potentially elevated body burden of uranium is interference with bone marrow storage of iron and renal toxicity. Persistent, markedly elevated hair uranium may indicate a need for supplemental iron. Some practitioners well versed in the interpretation of hair tests consider hair uranium levels somewhere above the range of 0.25 to 0.5 mcg/g to be clinically significant, with fatigue being a typical symptom in this situation. There are various published studies suggesting that chronic uranium exposure may lead to subtle renal problems. Investigations might include microalbuminuria, beta-2-microglobulin, as well as creatinine clearance, if renal effects are suspected.

Since renal clearance is the primary route of clearance, a finding of elevated hair uranium should be followed up with a first morning urine collection to test for uranium. If first morning urine is elevated, then this would reflect systemic absorption of uranium (as opposed to adsorption on to hair from hairwashing.) The next step would to assess drinking water. Canadian drinking water guidelines set the upper limit for acceptablity at 20 ug/L. Individuals with a hair uranium level in the red or purple "zone" along with elevated urine uranium excretion should have their drinking water tested. If drinking water approaches or exceeds 20 ug/L, appropriate measures would include water filtration to remove uranium or switching to a different water supply.

The conservative half-life for bone uranium is estimated to be 180 to 360 days. If the source of exposure can be isolated and eliminated, it may be expected that uranium levels would subsequently subside to a minimum after 2.5 to 5 years without other intervention. Opinions vary widely as to whether uranium accumulated by chronic exposure can be eliminated by chelation. It is probably more important to support the bone marrow and kidneys, while seeking to eliminate exposure.

GENERAL COMMENT ABOUT ELEMENT RATIOS
Some hair testing laboratories make extensive use of the ratios of various elements in their interpretations. There is controversy regarding the validity of element ratios derived from samples which are subjected to a wash procedure in the laboratory. RMA uses a wash procedure prior to analysis. A selection of the more common ratios are included in this report for the convenience of those practitioners used to working with ratios; however, the commentary provided for these ratios is not extensive. In some instances, a ratio might be prominently abnormal (red or purple bar) but there is no accompanying commentary. This means the Medical Director is not aware of any clinical significance for that particular abnormality. There might be deep meaning to the finding that we are not aware of. Note that even if essential element transport is abnormal, the ratios are still deemed to be valid in most cases.

RATIO: Na/K ABOVE NORMAL (YELLOW, RED OR PURPLE BAR POINTING RIGHT)
The ratio: Na/K is 4.3. This result is more than one standard deviation above the mean. Some practitioners who routinely use hair testing feel that an elevated Na/K ratio may be an indicator of acute stress, and may also be associated with a tendency to inflammation and sympathetic dominance (physically and mentally active, tendency to worry, tendency to push oneself too hard). It is also felt that an elevated ratio is associated with deficiencies of zinc and magnesium.

HIGH RATIO: Na/Mg (YELLOW, RED OR PURPLE BAR POINTING RIGHT)
The ratio: Na/Mg is 1.6. This result is more than one standard deviation above the mean. Some practitioners who routinely use hair testing feel that a high Na/Mg ratio may be an indicator of excessive adrenaline (epinephrine) output. Excessive adrenaline can be associated with anxiety, hyperactivity, panic and poor immune function.

George Gillson, MD PhD
Medical Director

Note: The College of Physicians and Surgeons of Alberta considers hair element analysis to be complementary medicine. Analysis of elements in hair has been used in research but is not approved for diagnosis of toxicity or deficiency states. Rocky Mountain Analytical does not diagnose or make treatment recommendations. Data is provided for research and educational purposes only.