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Hair Mercury Testing:
An Accepted and Viable test

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Recently, it was brought to my attention that an inaccurate article on mercury testing appeared on a website that is dedicated to discrediting and eliminating alternative health therapies. The article titled; Dubious Mercury Testing, written by a Dr. Robert Baratz appears to be focused on discrediting any possibility that mercury amalgams could contribute to clinically significant levels of body mercury burdens, even while admitting that amalgams will tend to increase levels of mercury in the blood and urine. The author makes this claim despite the fact that many researchers have reported and published data that has shown amalgams can contribute to increased mercury exposure. ***(Lorscheider, F., et al. Mercury Exposure from "silver" tooth fillings: Emerging Evidence Questions a Traditional Dental Paradigm. FASEB J. 9, 1995*** ***(Lorscheider, F., et al. Mercury Exposure from "silver" fillings. Lancet 337, 1103, 1991) (Siblerud, R.L. The Relationship Between Mercury From Dental Amalgam and Mental Health. Am.J. Psycho. Vol.XLIII, 4, 1989)*** In fact, there is so much information and evidence available, that some countries are projecting a ban on the use of mercury compounds in dentistry. ***(Grandjean, P. et al. Mercury Poisoning. Lancet Vol.342, 1993)***

I do not wish to debate in length the issue that mercury amalgams can contribute to significant mercury levels in the body and cause a host of related health disturbances, I do however want to take issue with his statements that hair mercury testing is "dubious". In the section under Hair Analysis the author makes the following statement, "Hair mercury levels are not an accurate indicator of mercury exposure. Hair testing has never been standardized to provide meaningful information. In fact, it cannot be standardized." In response, I can say that this is an incredibly uninformed statement. Analysis of mercury levels in hair have been standardized for many years, here in the U.S. and many other countries as well. One study reported that reproducibility of mercury results in different laboratories was within 6.3 percent. ***(Anal. Chim. Acta 84, 2, 1976)*** Data from other studies and from varying laboratories and authors also exhibit a good consistency. In fact, inter-laboratory studies conducted by Trace Elements, and involving three different laboratories revealed a reproducibility within 5 percent. It should also be noted that the Centers for Disease Control (CDC) under the U.S. Department of Health and Human Services incorporates hair mercury analysis as part of a public health objective. The CDC states that "Relationships have been established between the concentration of mercury in human scalp hair and dietary methylmercury exposure." State Health Departments, Bureau's of Epidemiology have adopted the use of scalp hair for determining mercury exposure. Further, the U.S.

Food and Drug Administration publication ***(FDA 95-1206)*** states "The best indexes of exposure to methyl mercury are concentrations in hair and blood. The average concentration of total mercury in non-exposed people is about 8 parts per billion (ppb) in blood and 2 parts per million (ppm) in hair". Parenthetically, the FDA in conjunction with the National Institute of Environmental Health Sciences have supported studies by the University of Rochester to gather data on the effects of long-term exposure to low levels of methylmercury in the fetus and infant using hair mercury analysis. The World Health Organization (WHO) many years ago adopted as the international standard for the upper tolerable level of mercury in hair as 5 ppm**.** ***(WHO Evaluation of Certain Food Additives and the Contaminants Mercury, Lead and Cadmium. Geneva, Switz. WHO; 1972. Tech. Rpt. Series 505)*** Other reputable scientific studies have supported the WHO guidelines as well**.** ***(McKeown-Eyssen G, et al. Methylmercury exposures in northern Quebec, II: neurologic findings in children. Am.J. Epidemiol. 1983;118)***

Further in the article, the author makes this statement, "Traces of everything eaten, imbibed, or breathed can end up in the hair. While hair analysis may be of use for detecting substances--such as arsenic-- that are not part of the normal environment, mercury is ubiquitous and is normally found in the hair, whether the person has mercury fillings or not. It gets there from food, water and air."

To begin with, the fact that what is consumed, and inhaled ends up in the hair is a logical and supportable argument for the validity of hair mineral analysis in itself. Further, saying that arsenic is not part of the normal environment is another vastly uninformed statement. The fact is, arsenic is quite prevalent in the environment, and is a naturally occurring element in the earth's crust. The abundance of arsenic in the lithosphere is 1.5 mg/kg, compared to mercury at 0.05 mg/kg, making arsenic significantly more abundant than mercury. The Agency for Toxic Substances and Disease Registry, Public Health Statement (1989) states; "Arsenic is widely distributed in the environment, and all humans are exposed to low levels of this element". For most people, food constitutes the largest source of arsenic intake (about 25 to 50 micrograms per day). Whereas, estimated dietary intake of mercury is only 2.89 micrograms per day, much lower than arsenic. Arsenic is also released into the environment from industrial emissions, combustion of coals and fuels, as well as its long time use in agriculture. Arsenic compounds are used as defoliants, fungicides, herbicides, insecticides, algaecides and paints. Arsenic has long been used as a wood preservative. You can tell the woods containing arsenic as they have a greenish color and are used as heavy beams for retaining walls, building materials, wooden posts, playground equipment etc. Therefore, arsenic is normally found in human hair and blood just as is mercury. However, neither toxic metal should be present in excessive amounts. Extensive use of amalgams as well as mercury preservatives in vaccines could be exposing hundreds of thousands of individuals to unnecessarily high levels of mercury. The fact that this continuous mercury exposure raises the average hair and blood mercury levels to higher levels than the average arsenic level should not be construed as normal by any means. Perhaps if amalgams contained appreciable concentrations of arsenic instead of mercury, the author would consider high arsenic levels within the body as being normal as well.

The author continues, by stating "Mercury can be accurately measured in the blood and also in urine. Hair is similar to the outer layer of the skin and has no blood supply. Thus the amount of mercury in hair does not reflect the concentrations in the rest of the body." First, saying that measuring mercury in the blood and urine is always accurate is certainly not the case. The blood is a major transport medium of metals after absorption from the GI tract, lungs and skin. Metals are transported in the blood to various tissues and organs where they accumulate, and can be

termed as body burdens in the case of heavy metals. Heavy metals can also be released by these organs and tissues back into the blood. The blood is therefore influenced by current metal exposure as well as concentrations in the organs and tissues (body burdens). Metals in the blood, depending upon the element, are bound to the red blood cells (RBC's) or plasma proteins. Mercury, lead, and cadmium for example are bound to the RBC's. If an individual has a low hematocrit or is anemic the amount of mercury, cadmium or lead found will be artificially low, even if an ongoing exposure is occurring or if an excessive body burden exists. If blood and urine samples are stored for long periods they have a tendency to dry out. The results of mineral analysis on such samples would result in erroneously high levels. Metals can be attracted to and react with the walls of the container thus resulting in a lower than actual amount being found. Also the concentration of a metal in the blood or urine can vary with time. Following an exposure to a toxic metal, the body attempts to eliminate it and/or store it into the tissues and organs. Depending upon the specific metal and the time following an exposure, the blood and urine may not reflect an exposure and therefore have not been considered good indicators of body burdens. As stated in the NCCLS Guidelines, ***Control of Preanalytical Variation in Trace Element Determinations; Approved guideline, C-38-A Vol. 17, No.13, 1997,*** "much of the pioneering published research in trace elements analysis of blood and urine was based upon erroneously derived reference interval data. The source of the problem was a lack of recognition of exogenous specimen contamination occurring at the collection, handling, transport, preparation, or analytical stages." Collection tubes and needles can be a significant source of contamination. Fingerstick methods of obtaining blood for lead analysis in children is routinely used, but is highly prone to contamination errors. Despite these problems with blood and urine, some of the gross contamination errors that occur with these collection methods are still considered acceptable because they may result in a false-positive instead of a false-negative result. Other factors that can erroneously affect blood and urine mineral tests include, eating fruit, or seafood a few days prior to the sample being taken, consumption of juices, tea, or beer within 24 hours of specimen collection, medications, mercurial antiseptics, illness and normal diurnal variation and individual lifestyles.

Hair is a keratinized tissue consisting of protein. As the hair is being formed it is exposed to the internal metabolic environment including the blood, lymph, and extracellular fluids. Constituents entering the body are then accumulated into the hair and reflect a time-weighted exposure record of nutritional and toxic metal intake. The previously sited sources of State, Federal and World Health Organizations are in strong disagreement with the author's statement that hair mercury does not reflect concentrations in the body. Many other researchers as well as myself also disagree. For example, a report by Wilhelm, Muller and Idel, found that scalp hair was a useful indicator of internal mercury exposure. ***(Wilhelm, M. et al. Biological monitoring of mercury vapour exposure by scalp hair analysis in comparison to blood and urine. Toxicol Let. Nov; 88: 1-3 1996)*** Their study involved dental students in which hair, blood and urine was tested prior to and following their first exposure to mercury as operating dentists. All biological tests reflected exposure and the hair mercury correlated with blood levels. Exposure to mercury from dietary intake also reveals a distinct correlation between hair and blood mercury levels. ***(Suzuki, T. et al. Mercury in red cells in relation to organic mercury in hair. Tohoku. J. Exp. Med., 116, 4 1975)*** Numerous other studies have also shown a relationship to mercury exposure as well as other minerals as measured in the hair with body accumulation from polluted areas as well as minerals in local soils. ***(Gebel, T., et al. Biological monitoring of persons in areas with increased soil mercury, arsenic and antimony content. Gesundheitweesen 1998 60, 10) (Tommaseo, P.M., et al. Trace elements in human scalp hair and soil in Irian Jaya. Biol.Trace***

Elem. Res. 62 1998) The author continues, "Measurements of blood and urine from thousands of people have never shown high levels of mercury in the general population. Only workers with high work exposure have shown abnormal levels in blood and urine, but these are not in the toxic range." Regarding this statement, I am not sure how to interpret this strange logic. This laboratory has also performed hair mercury tests on hundreds of thousands of people and also have not found high levels of mercury. However, it is those individuals that do in fact have high levels of mercury that is of utmost concern. Over the years we have certainly seen many individuals in the general population who have excessive mercury levels and who were not occupationally exposed. We have found numerous cases of mercury toxicity that were eventually traced to such sources as contaminated fish, children playing with broken mercury thermometers, vaccinations (thimerosal mercury preservative), skin lightening creams, burning treated lumber in home fireplaces, home gardeners exposed to herbicides, etc, not to mention the many polluted soils, lakes, rivers and water supplies. Many cases of industrial mercury release have also been found in surrounding neighborhoods as well as in areas of naturally occurring high mercury concentrations. Just recently, we have had individual cases of excessive mercury exposure traced back to homes and even schools***. (Mercury contamination in the home. Lancet Vol. 347, Apr.13, 1996) (The Wall St. J. Sept. 24, 1985. Mercury Exposure of Workers Ignites Vermont Controversy. Factory employees tracked substance into dwelling: Fears of future effects) (Clarkson, TW. Environmental contaminants in the food chain. Am.J.Clin.Nutr. 61, supl. 1995)*** And of course, needless to say excessive levels have also been found in individuals with dental amalgams.

The author states that, "Hair grows at different rates in different individuals and its composition is quite variable. Measuring mercury means measuring an absolute amount that is compared to the weight of the whole hair; that is, determining the concentration, expressed as micrograms of mercury per gram of hair. However, the amount of a substance absorbed into the hair is influenced by surface area and hair composition. Since hair thickness, density, shape, and surface area vary from person to person, one cannot make a "standard" comparison." To answer, it should first be mentioned that hair thickness, density, shape, etc., has no effect on the amount of substances incorporated into the hair from the internal metabolic environment (ingestion, inhalation, etc..) during its period of growth and formation. However, these factors will affect external contamination. Second, the author should know that blood cells are also produced at different rates in different individuals and composition is also variable. These basic physiological facts are well known and there are proper procedures that are necessary for obtaining a representative blood sample as well as a representative hair sample. Reporting of measured concentrations are normally based upon an absolute value based upon the whole, weight or volume. For example blood cholesterol is reported in milligrams per deciliter (mg/dL). We do not have to measure every drop of blood in the body to determine the total amount of cholesterol. The clinician need only use a small amount to test and then extrapolate the results based upon established methods.

Another questionable quote the author makes is; "Hair is subject to washing, shampoos, rinses, colorants, sun exposure, swimming, hair dyes, and a host of other treatments. Substances can be removed from the hair by these treatments as well as added. With some substances being added and others being removed, it is clear that the relative concentration of any particular substance, especially a metal, changes constantly and is thus uncertain." First, all laboratories that perform hair mineral analysis are well aware of the possibilities that can contribute to contamination. ***(Watts, DL., Variations in Hair Trace Element Analysis, TEI Newsletter 11, 4, 1999)*** This is why a proper

collection protocol is stressed for obtaining a hair sample as well as recording any type of hair treatment. Some dyes that contain lead acetate do contribute to artificially high hair lead levels. Some medicated shampoos contribute to artificially elevated selenium and zinc. Bleaching can contribute to calcium, and permanent wave solutions can contribute to a spuriously high magnesium level. However, there is little that will contribute to artificially elevated levels of mercury. As stated by Friberg, et al, "methylmercury occurs in certain foodstuffs, particularly fish, and problems due to external contamination (of hair samples) are rare. Mercury is incorporated in the hair during the growth phase, and a close association has been found between mercury in whole blood and hair. Determining methylmercury in different parts of the hair strands, at various distances from the scalp has made it possible to reconstruct exposure to methylmercury during different time periods. Analysis of hair taken, for example, 10 cm from the scalp will give a good indication of the mercury content in the blood about 300 days earlier. Several studies have shown that the prevalence of symptoms or signs (of mercury exposure) are related to the concentration of methylmercury in hair."***(Friberg, L., et.al. Scand. J. Work Environ. Health. V il 19, suppl.1, 1993.)***

We have performed analysis on many popular hair treatments at our laboratory, and have not found any significant source of contamination other than those mentioned previously. The effects of hair treatment on hair mineral levels have also been reported by others and found that " the degree of contamination on the hair is negligible. Only one shampoo tested, formulated with selenium sulfide, was found to seriously contaminate the hair." ***(LeBlanc, A., et al. Trace element content of commercial shampoos: impact on trace elements levels in hair. Sci. Total. Environ. May 7;229, 1999)***

The author makes the following final derogatory statement; "... it should be obvious that analyzing hair for mercury is a waste of time and money and cannot be used to diagnose mercury poisoning. A competent practitioner would easily know this". The author lists two insignificant references for his entire criticism, totally unrelated to the subject matter. His comments would seem to be quite unreasonable, uninformed and an unprofessional attack on those health professionals and researchers that utilize this important laboratory screening tool. As has been stated by others, there seems to be some kind of hidden agenda in his embracing of mercury amalgams and statements that mercury exposure from this source is safe and insignificant. Again, I do not wish to get into a debate on whether or not amalgams contribute to body burdens of mercury, as I'll leave that to other researchers that have demonstrated that mercury from this source can cause mercury sensitization. For instance, Mori, T., and colleagues reported that mercury sensitization is associated with increased hair mercury concentrations and their study confirmed that dental amalgams are a contributing factor. ***(Mori. T, et al. Mercury sensitization induced by environmental exposure. Nippon Eiseigaku Zasshi. Jan; 52, 4, 1998) (Zamm, A.V. Dentral Mercury: A Factor That Aggravates and Induces Xenobiotic Intolerance. J. Ortho. Med. Vol.6,2, 1991)*** Mercury is a well-known poison and neurotoxin and many people are suffering from its cumulative effects. Knowing this, why should we be persuaded to carry it around in our bodies?

In conclusion, many competent practitioners have used hair tissue mineral analysis when other tests were inconclusive, in recognizing this poison in their patients from a variety of sources. By doing so, they have helped to bring to an end considerable and needless suffering experienced by their patients. Since hair is not significantly subject to external environmental contamination from mercury, it stands as one of the most useful tests in detecting this often hidden and common poison in non-occupationally exposed individuals.

UPDATE: Norway recently announced a ban on the use of mercury, including dental amalgam, that took effect on January 1, 2008. Sweden announced a similar ban and dentists in Denmark will no longer be allowed to use mercury in fillings after April 1, 2008. PR Newswire