**CHAPTER 47:**

**HAIR ANALYSIS: VALIDITY & ACCURACY**

**INTRODUCTION**

*Not That I Am Poisoned*, Chapter 1, has tried to discredit the science of hair analysis altogether with this statement:

*“Hair analysis for arsenic is a very unreliable indicator of serum arsenic levels when a specific individual is tested without a range of reference values from a group of the same time and place for comparison. This unreliability is even more marked when a small amount of hair sample is tested.”*

At first look this statement sounds righteous, scientific, and profound, causing readers to think that hair testing for metals and poisons is very unreliable. However, these words are highly misleading and we will see that it makes no sense at all. Also *NTIAP* needs to diffentiate between serum (blood) and hair.

One should not be misled that individual hair analysis is unreliable. Group studies are required to establish norms and to understand variances due to local factors of pollution, occupation, and so on. But to compare an individual (such as Srila Prabhupada) to the average normal values found in various unexposed groups ***IS in fact a valid and reliable, scientifically accepted method of determining abnormal exposure or poisoning.***

**HAIR ANALYSIS IS A RELIABLE INDICATOR**

**(1).** The EPA (Environmental Protection Agency) published an authoritative study in 1979 in which more han 400 reports on hair testing were reviewed. The authors concluded that hair is a ***“meaningful and representative tissue for biological monitoring of most of the toxic metals.”***

**(2).** The Great Smokies Diagnostic Laboratories states: *“There are numerous papers on the accuracy and efficacy of hair testing, particularly for toxic metals such as mercury. For more than 30 years, the significance of measuring element concentrations in scalp hair, blood, and urine has been studied.”*

**(3).** A 1986 study by V Bencko, T Geist, et al called *“Biological monitoring of environmental pollution and human exposure to some trace elements”* states:

*“In addition to analyses of plant and animal specimens, the element content of human hair as an indicator of exposures to arsenic, mercury, cadmium, lead, antimony, manganese, nickel and cobalt has been* ***repeatedly confirmed as reliable****, provided the analyses were carried out and evaluated on group diagnostic basis and were done in groups of individuals occupationally not exposed to these metals.”*

**(4).** From Nutri-Test Analytical in Edmonton, we read: *“Blood, urine and hair are the most accessible tissues in which to measure elements in our body, and they are sometimes referred to as indicator tissues. Blood and urine concentrations usually reflect recent exposure and correlate best with acute effects. Hair is useful in assessing variations in exposure to metals over the long term. It is a useful tool for… diagnosis of heavy metal exposure…”*

**(5).** A 1980 study by JS Lee and KL White called “A review of the health effects of cadmium” found that *“hair values correlate well with exposure”* to cadmium, whereas blood values did not.

**(6).** A 1979 study published by the EPA by DW Jenkins called “Toxic metals in mammalian hair and nails” found that *“hair analysis, when properly performed, is a reliable measure of tissue levels of cadmium.”*

**(7).** A 1973 study by RW Thatcher et al called “Effects of low levels of cadmium and lead, etc” found that *“hair analysis is superior to blood in reflecting long term cadmium exposure.”*

**(8).** **WIKIPEDIA: Arsenic poisoning:** (2015) *“Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6–12 months. These tests can determine if one has been exposed to above-average levels of arsenic… Hair is a potential bio-indicator for arsenic exposure due to its ability to store trace elements from blood. Incorporated elements maintain their position during growth of hair.”*

***CONCLUSION:***

Hair analysis is not a very reliable indicator of total body burden, in other words, it does not directly correlate to the exact state of contamination in the body beyond the hair itself. But hair levels do give excellent relative indicators of abnormal contaminations that the body has been exposed to. In other words, the muscle, fat, organs, blood, and urine levels of any element may not be indicated by hair tests. But hair tests do show the presence of elements in the body that are compared to known normal levels in human society. Thus it is an excellent indicator of cadmium poisoning although it may not show much about the total body burden of cadmium or the state of health of internal organs.

**ARE HAIR TESTS BY DR. STEVE MORRIS ACCURATE OR NOT?**

 There are endless references in the scientific literatures about the practical use of hair analysis for study of heavy metals poisoning, albeit with deference to the need for inclusion of variabilities and uncertainties as previously discussed. Yes, one can find a very few claims online that hair analysis is unreliable, but these are largely in reference to poorly executed and ill-equiped commercial scams and questionable accuracies. Tests done at facilities such as Missouri University Research Reactor (MURR) are highly advanced, highly accurate, and highly reliable. Further, the science of hair analysis has progressed well beyond most of the pitfalls and typical errors of the past.

*NTIAP* has focused on an area of abuse by shady operations looking to hype the public and tries to stick that label on the entire science of hair analysis. For example, the existence of quack doctors does not mean there are no good doctors. Also we must note another contradiction within *NTIAP* as follows:

 FIRST: On pg. 123, Bhakticharu Swami minimizes the evidence by saying, “…based on some whispers and ***an incorrect and dubious analysis of some hairs***…” Obviously BCS does not put much value on Dr. Morris or his testing methods and results. Yet…

 SECOND: On pg. 318-9, the *NTIAP* author relates how he, on behalf of the GBC, approached Dr. Morris for testing Srila Prabhupada’s hair samples A and D. After abandoning those hair samples in Wisconsin, he then concluded *NTIAP* with these words: *“The ministry for the protection of ISKCON extends an open invitation to anyone who would like to fund* ***this analysis by Dr. Morris.*** *We will fully cooperate…”*

 The left hand says one thing, and the right hand says the opposite. Elsewhere in *NTIAP* it is stated that the tiny amounts of hair tested by Dr. Morris cannot be accurate and are unsuitable as evidence. The summary is that various ISKCON apologists and defenders of the prime suspects (and they themselves as well) will say whatever they can to create doubts and distraction from the real, hard evidence. This is the business of dishonest men. *NTIAP* is a very dishonest collection of statements meant to dissuade a reader from accepting the obvious value of the great mountain of hard evidence that Srila Prabhupada was maliciously poisoned with heavy metals.

 Further evidence of the accuracy of Srila Prabhupada’s hair tests done by Dr. Morris are the high correlations amongst the 18 values in the five tests that he did for us. His accuracies are confirmed by his determinations of similar values of various elements in the five hair samples. For example, we find similar antimony levels in D, A, J, and ND2, namely 0.66, 0.186, 0.080, and 0.13 ppm. This consistency in results also applied to samples that varied widely in mass.

 This can be seen simply by studying the graph of test results in Chapter 31.

**ACCURACY OF HAIR TESTS ON SMALL AMOUNTS**

 There seems to be a prevailing misunderstanding in some quarters about whether it is possible to achieve satisfactory accuracy in testing the typically small amounts of hair that make up Srila Prabhupada’s hair relics that are kept as keepsakes by devotees. For example, Hari Sauri das expressed this sentiment to Yudhisthir das (Nityananda) in an email when referring to sample Q-1, which Balavanta had Dr. Morris remove from off the cutter blades of Srila Prabhupada’s hairclippers. Hari Sauri said:

 *“Balavanta dismantled the clippers and found some hair fragments under the blades but these were not nearly big enough to do reliable tests on. The hair samples I got later on from Daivi Shakti which were sent to America for testing independently of Balavanta’s investigation were much bigger and probably sufficient to get a fairly accurate reading.”*

 *NTIAP* authors sent samples A and D supplied by Hari Sauri to two US labs for testing, namely Larry Kovar’s General Activation Analysis and Dr. Cashwell at the University of Wisconsin. Both labs were unable to test these relatively larger samples due to their equipment being unsuitable for such small masses of material. There are very few places on this planet that can accurately perform neutron activation analysis on hair samples of the sizes we are dealing with, and the GBC author failed to find one. As a result, the idea that tests on small amounts were doomed to inaccuracy was born. But it all depends on the accuracy of the equipment and the expertise of the laboratory.

 The Research Reactor Center at the University of Missouri which was headed by Dr. Steve Morris is fully capable of the accuracy which we require. The Srila Prabhupada hair samples tested by Dr. Morris were between 0.00012 and 0.00310 grams in weight. Dr. Morris wrote to Nityananda das about accuracy in early 2000:

 *“As you have already discovered, these small samples are beyond the reach of most neutron activation analysis laboratories. We (U. of MO.) can accurately analyze them at the MURR for arsenic with a sensitivity of 1 E-11 grams. Assuming the mass of the sample to be 1 milligram (0.001), our sensitivity translates to a detection limit of approximately 0.01 to 0.1 ppm. This is well below the level of arsenic one would expect in a hair specimen from a person who had been subjected to arsenic poisoning. (However,) these analyses are costly, primarily because of the sample size.”*

 Thus Dr. Morris’s accuracy on a normal level of arsenic of 0.2 ppm would be within the range of 0.1 to 0.3 ppm, shown as 0.2 ppm ( ± 0.1 ppm). His accuracy on an abnormal level of arsenic of 2.6 ppm as found in Srila Prabhupada’s hair sample Q-1 was ± 0.1 ppm, or within a range from 2.5 to 2.7 ppm. Sometimes scientists conduct studies without adequate accuracy in their tests and this is indicated by the variance factor. For example, *NTIAP’s* star study involved a 4.6 ppm reading from Mexico City, and listed the variance factor as ± 1.9 ppm (or 2.9 – 6.7 ppm), or about 50% accuracy. Obviously such lack of accuracy very seriously reduces the value of the test. Dr. Morris does not, however, have this problem.

Also, it is noted that the FBI performed tests on two separate single hairs of Napoleon in recent years, having no difficulty in achieving accurate findings because they had equipment and techniques appropriate for such small amounts. The Napoleon hairs were lineally and segmentally tested to discover the various levels of arsenic from one end of the hair to the other, giving a poisoning timeline history.

Measuring of arsenic by neutron activation analysis (NAA) is an extremely sensitive method. Nevertheless, the method has its limitations. When it is used on less than 1 mgm. of ordinary hair it yields values which tend to be obscured by the background, unless the testing facility has the time, patience and equipment to cope with these situations. Dr. Morris is properly equipped and patiently took the required time to do the tests accurately for our investigation. He diligently compensated for the background readings.

**NEW METHODS FOR MICROANALYTICAL HAIR ANALYSIS**

A decade after Dr. Morris’ last test, science had developed new, even more accurate methods for tiny amounts of hair analysis, for both heavy metals measuring and DNA comparisons. ***Hair analysis by qualified labs is extremely accurate and reliable.***

From Wikipedia (2015) Arsenic Poisoning, we find: “Thus for a temporal estimation of exposure, an assay of hair composition needs to be carried out with a single hair which is not possible with older techniques requiring homogenization and dissolution of several strands of hair. This type of biomonitoring has been achieved with newer microanalytical techniques like Synchrotron radiation based X ray fluorescence **(SXRF)** spectroscopy and Microparticle induced X ray emission **(PIXE).**The highly focused and intense beams study small spots on biological samples allowing analysis to micro level along with the chemical speciation.”

**OPEN ENDS:**

**Future hair tests may use these new methods for great accuracy on tiny samples.**

**EXOGENOUS OR ENDOGENOUS ?**

 One of the first skeptical responses to a finding of high levels of heavy metals in a hair test is: *“Maybe it is due to external contamination.”* In other words, speculation races to question whether the poison in the hair had derived from the internal blood deposition process, called endogenous, or whether it originated from external sources, called exogenous. This question revolves around the difference between hair adsorbing poison through its overall exposed surface area, or whether the poison was bound into the hair from the blood at the growing hair root.

 To establish a poisoning wherein poison was ingested internally, the poison in the hair being tested should reliably be found to have endogenous or internal sources. The standard approach to this problem is to reasonably exclude external contamination as a possibility. The factors by which such exogenous origins occur are summarized below.

Dr. Morris decided not to wash Samples A and D before testing. Sample washing can have very serious effects in the compromising of results and was of limited value anyway, he explained. By powerful microscopic examination he had not found any significant amount of external debris on the hair samples; they did not show evidence of external contamination, such as oils, chemicals, or whatever. Also, he referred to scientific literature on hair analysis that had found hair very close to the scalp, as these samples were (the first half inch), was least likely to have been ***externally contaminated***. Also another US study on the validity of hair mineral testing found that much of the variance in results was actually due to the washing steps used by some labs in their faulty attempts to address external contamination issues.

Sometimes a reference will be found that ***appears to say*** that hair analysis does not actually show if there is poisoning in the body, or that from body burden to hair values there is a poor correlation. As an example, the CDC (Center for Disease Control, USA) has this on their website about cadmium in hair:

*“Studies of exposed workers have not found a quantitative relationship between hair cadmium levels and body burden. Because of the potential for sample contamination, hair levels are not reliable either as predictors of toxicity or as indicators of occupational exposure."*

In reply to this, we borrow a chart from Ch. 33 to show the extent of Srila Prabhupada’s cadmium levels in his hair, just to illustrate that we are NOT dealing with a typical exposed industrial worker who may have, as shown, an average of about 0.387 ppm cadmium. Srila Prabhupada had 40 times that amount !

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**CADMIUM LEVELS: Comparison chart showing amounts of Cadmium in ppm, from 0 to 16 ppm.**

1. **SRILA PRABHUPADA: 15.75 ppm, 250 X normal**
2. **Worst waste dump: 4 ppm, 60 X normal**
3. **Highest Value at ARL: 2 ppm, 30 X normal**
4. **Dr. Hudson: “hefty load”: 1 ppm, 15 X normal**
5. **Average Exposed Industrial Worker: 0.387 ppm, 6 X normal**
6. **Verage Normal Unexposed Person: 0.065 ppm.**

The concern by the CDC is, as they state, about external contamination to the hair that will be tested, thus giving a false positive. But Dr. Morris knows all about the pitfalls of doing hair tests in the wrong ways that would give misleading results. He microscopically examined the hair samples he tested for the Truth Committee and found no signs of external contamination. Dr. Morris and thousands of other scientists worldwide DO use hair analysis as a normal procedure which gives accurate and useful results, meaning that hair DOES indicate the body burden of various elements and compounds. That is, until the hair becomes externally contaminated and is not checked for such in advance of the test.

Dr. Morris did not run a commercial outfit that rams hundreds of tests daily through an automated process, as some online hair testing companies do. He took the time to properly prepare EACH test uniquely, with its own set of fine-tuned parameters and settings of his nuclear testing equipment. Although there is some concern about misleading results due to external contamination, as done by commercial, high-numbers outfits, this in no way invalidates the science of hair analysis as a whole. Otherwise, why are scientists and researchers the world-over doing testing hair? What would be the reason to continue funding Dr. Morris’ MURR facility with tens of millions of dollars over four decades if he was doing meaningless hair tests? The fact is that hair analysis, especially by NAA, is a very valid and accurate scienctific method to determine the body burden of poisons. Whatever is in the blood will be deposited into the growing hair at the same concentration level. The fact is that “buyer beware” applies to one who wants to do a hair test- they must find a reputable concern who will know how to deal with the external contamination issue. Dr. Morris does.

Also, the CDC quote above refers to a comparison between unexposed persons (average 0.065 ppm cadmium) and exposed persons (average 0.387 ppm)- which is a multiple of only SIX times. However, Srila Prabhupada had a multiple of 250 times, and this result is so dramatic and skyhigh that it completely trumps any possible question of inaccuracy from exogenous contamination- the possibility of which Dr. Morris had already eliminated by microscopic examination. Samples A and D are definitely and accurately indicative of the massive cadmium poisoning which Srila Prabhupada endured.

**COSMETICS, SHAMPOOS, HAIR COMPOUNDS, MASSAGE OILS**

For example, selenium in dandruff shampoos often will result in high hair selenium values due to “external contamination.” Hair dye, creams or sprays, hair straighteners, and other chemicals applied to the head can cause external contamination of the hair and produce false positives upon testing. These external chemicals will be adsorbed through the hair walls into its internal structure. Therefore the personal history and habits of a person should be learned to reasonably rule out the possibility of external or exogenous hair contaminations.

However, Srila Prabhupada did not use these kind of compounds on his head, and furthermore, none of these compounds could ever contain such high amounts of heavy metals such as arsenic, cadmium, or antimony. Srila Prabhupada used brahmi and mustard seed oils in massage, which would not have any heavy metals in them.

**AIR CONTAMINATION**

Also, if someone resided near industrial smelters, it would be expected that perhaps smelter dust would find its way into the microscopic crevices of the hair surface and be measured as though it were part of the hair. However, scientific studies have determined that hair near the scalp will not be contaminated in this manner to any regular or measurable degree. Srila Prabhupada’s hair, of course, never grew much over a half inch in length before it was cut, so his hair was always close to the scalp and would not be externally contaminated by substances in the air to any significant degree. Moreover, Srila Prabhupada did not reside near smelters or industrially contaminated areas.

**HAIR CONTAINERS**

The Srila Prabhupada hair samples which were tested between 1998 and 2005 had been stored in assorted types of containers for twenty or more years. It is conceivable, however implausible, that external contamination of the hair occurred due to poisonous elements present in the composition of those containers. For example, some hair samples were kept in cheap little Indian metal canisters or pillboxes which might have been coated with cadmium.

The containers which held the GBC samples D and A were tested by Dr. Morris and found to have *“no evidence of significant contamination sources for arsenic, cadmium, antimony, or mercury.”* Similarly, the container which held my hair sample ND-2 was tested and was found neutral. Therefore it is very safe to state that no cadmium, arsenic or antimony was adsorbed into these hair samples from external contamination while sitting in these containers. Such a proposition would not really make sense anyway, unless the metal containers deteriorated and chemically dissolved so that the hair might adsorb the chemicals. The containers in question, however, had not corroded at all.

**DIFFERENT ELEMENTS VARY IN EXTERNAL ADSORBABILITY**

Scientific studies have ascertained the degree that each element has been found likely to adsorb externally into human hair. Copper in hair has been found to originate about 20% from external sources. However, cadmium, antimony, and arsenic have been found to be not easily adsorbed from external sources into hair.

Great Smokies Diagnostic Laboratories states*: “Experience has shown that hair is not very sensitive to exogenous contamination from environmental exposure to antimony.”*

 Since cadmium and arsenic are not readily adsorbable externally, significant external contamination would be unlikely. Note, for example, the studies of those residing in cadmium polluted areas: they usually had only slightly higher levels of hair cadmium than normal.

 A study in 1990 by M Wilhelm et al called “Cadmium, copper, lead, and zinc concentrations in human scalp and pubic hair” stated: *“It is concluded that hair metal analysis in samples close to the scalp is not seriously invalidated by sources of external contamination.”*

 Therefore it is not a plausible posture that the cadmium or arsenic in Srila Prabhupada’s hair originated exogenously. External contamination is not a plausible explanation for Srila Prabhupada’s arsenic or cadmium levels. Endogenous origins is the correct explanation. Srila Prabhupada’s hair contains these toxic heavy metals because Srila Prabhupada ingested them by malicious homicidal poisoning.

**CONCLUSION**

 Reliability and validity in hair analysis when properly performed with advanced equipment and technology is a widely accepted practice in the scientific community, despite a few critics (as there are in almost anything). These hair tests can also be extremely accurate even with very tiny sample quantities. External contamination of hair to be tested is a valid concern, but upon review, we see no credible concern of this being the case with the Srila Prabhupada hair samples that were tested between 1998-2005.