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Biometric Authentication using the elements in the hair

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Abstract

Biometric authentication is a security process that relies on the unique biological characteristics of an individual to verify that he is who is says he is. Biometric authentication systems compare a biometric data capture to stored, confirmed authentic data in a database. If both samples of the biometric data match, authentication is confirmed. Human hair consists of proteins, lipids, water, trace elements ,toxic elements, other elements and pigments. The composition of the elements may vary from one hair of one human to another human. the elements present in the hair can be consider for biometric authentication. the various elements in the hair can be calculated and this will be a part of a bio metric authentication. this can be highly useful in the smart cards In the future. The main component of hair is protein and amino acid. The percentage of elements in the hair may vary to each human being. This paper present the theoretical aspect of all the elements in the hair and how it can be used for biometric authentication.

Key words

Elements, protein, biometric Authentication, amino acid in hair.

1.Introduction

The dominant contributor in the **composition of hair** is protein, accounting for 91 percent of **hair** fiber. Amino acids, the building blocks of protein, are made up of COHNS elements, (Carbon, Oxygen, Hydrogen, Nitrogen and Sulfur. The purpose of this study was to evaluate and monitoring o f humans for exposure to certain trace elements in the hair. The (trace) elements belong, like the vitamins, the essential amino acids and essential fatty acids elements human beings need to be able to function properly and that the human being is unabuce from food. (Trace) elements are crucial parts of many kinds of biochemical conversions I n the body, such as co-enzyme reactions. Deficiency or excess of (trace) elements can lead to adecreased function of several (organ) systems and the human body as a whole. Other elements and toxic metals can influence the need for a (trace) element. Consequently ratios are sometimes also important.

3.ELEMENTS IN HAIR

Carbon 51%

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2. **About Human Hair**

- Human hair is present on all over your body and not just where you see it (e.g., on your scalp, pubic region, hands and the legs). The hair on the face, forehead, and the cheeks, though present is invisible, but it is there. Its life cycle is about 2 to 7 years. You can describe the cycle in three words: — rest, shed and grow.
- Ninety percent of it is in a growing phase at any given time and 10% is in the resting phase.
- That, which is in the resting phase falls off within 2 to 3 months and new hair begins to grow in its place.
- It grows at the rate of about one cm per month, faster in summer than in winter.
- It grows at the rate of 0.3 to 0.5 mm per day.
- Normally, you do shed it every day. You lose about 50 to 100 hairs every day.
- There are 100,000 to 150,000 hairs on a normal scalp.
- The diameter of human hair is 0.1 mm
- It can tell if you smoke, drink, or take drugs, but it cannot tell your gender.
- A single hair strand can support about 100 grams weight.

2.1. Functions of hair

The hair on each part of your body has different functions perform. For example,

- It protects the scalp from the heat and the ultraviolet radiation from the sun and keeps your scalp warm during the cold.
- The eyebrows protect the eyes from the sweat coming down from your forehead.
- The eyelashes protect the eyes from the dust and filter off extra light.
- In the nostrils and the ear, it prevents foreign particles such as dust and insects from entering.
- The hair on the body is connected to the sensory nerve endings (touch receptors) in the skin and helps you feel the breeze and any foreign object making you aware of its presence.
- The function of the pubic hair and that in the armpits is to act as a cushion against the friction of skin rubbing against skin and preventing any abrasion and subsequent infection.
-

Statistics: Black/Brown-haired people have 25% more growth than red-haired people while the blond people have 25% more growth than black/brown-haired people.

- It is the fastest growing tissue in the human body after the bone marrow

THE TEST

The trace(elements) in a hair test can provide insight into absolute and relative deficiencies, toxicities

and imbalances between elements. Elements, in particular trace elements are accumulated in hair at concentrations that are generally 10 to 50 times higher than those in bloodare. Because of these higher levels, more elements can be measured in hair than in blood.

For the test 1 gram of hair is needed. Only the hair from the nape of the neck that is closest to the scalp should be used. This is the hair that grew most recently. Hair that is at more than 3-cm distance from the scalp should be removed.

TEST INDICATIONS

- A total elements check-up is advised in case of:
- Poor (general) health
- Suppressed immunity/ allergy
- Exposure to toxic metals
- Cardiovascular diseases
- Glucose-intolerance/hypoglycemia
- Cancer
- Vague complaints and aspecific symptoms like fatigue and headache
- Psychological, behavioral and learning difficulties/ mental diseases
- Complaints of joints and bones
- Monitoring the effect of suppletion
- Preventive purpose/ to detect subclinical deficits
- Check possibilities of optimizing health//performance

Scalp hair is an almost ideal test object for such population sampling; it is painlessly removed, Not exposure covariate for some elements With the comparatively recent development of analytical techniques of great power and sensitivity, the amino acid constituents which provided important information on the relative amounts of different functional groups in different types of hair and in different regions of the fiber. However, as a result of advances in the characterization and classification of the different proteins and genes of keratins and keratin associated proteins the focus today is on the proteins themselves. The current state of changes in the amino acids, proteins and lipids of hair by morphological region (including KAP and keratin Proteins and where they reside), chemical and sunlight damage, diet, puberty and menopause, and other factors

Chemical **composition of the hair**

The following 16 elements will be dealt with in this report: **barium** (Ba), boron (B), cadmium (Cd), chro- mium (Cr), **copper** (Cu), iron (**Fe**), lead (Pb), lithium (Li), manganese (Mn), **mercury** (**Hg**), nickel (Ni), se- lenium (Se), silver (Ag), tin (Sn), **vanadium** (V), and zinc (**Zn**).the elements and their compos

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Element	Element Abundances in Human Hair *Click to see citations*
Carbon	540×103 ppm
Oxygen	245×103 ppm
Nitrogen	160×103 ppm
Sulfur	42×103 ppm to 60×103 ppm
Hydrogen	29×103 ppm
Chlorine	1×103 ppm to 4.8×103 ppm
Calcium	150 ppm to 3200 ppm
Silicon	20 ppm to 2×103 ppm
Sodium	18 ppm to 1700 ppm
Potassium	150 ppm to 660 ppm
Zinc	220 ppm
Phosphorus	83 ppm to 165 ppm
Magnesium	19 ppm to 160 ppm
Lead	3 ppm to 70 ppm
Bromine	0.65 ppm to 53 ppm
Iron	5 ppm to 45 ppm
Copper	19 ppm
Aluminum	4 ppm to 29 ppm
Fluorine	<15 ppm
Iodine	0.1 ppm to 15 ppm
Cesium	0.37 ppm to 1.1 ppm
Titanium	0.08 ppm to 14 ppm
Boron	5 ppm

Element	Abundances by Element Name in Human Hair *Click to see citations*
Aluminum	4 ppm to 29 ppm
Antimony	0.09 ppm to 3 ppm
Arsenic	0.06 ppm to 3.7 ppm
Barium	0.55 ppm to 4 ppm
Berylliium	0.006 ppm to 0.02 ppm
Bismuth	2 ppm
Boron	5 ppm
Bromine	0.65 ppm to 53 ppm
Cadmium	0.24 ppm to 2.7 ppm
Calcium	150 ppm to 3200 ppm
Carbon	540×103 ppm
Cerium	0.25 ppm
Cesium	0.37 ppm to 1.1 ppm
Chlorine	1×103 ppm to 4.8×103 ppm
Chromium	0.13 ppm to 3.6 ppm
Cobalt	0.2 ppm to 1 ppm
Copper	19 ppm
Fluorine	<15 ppm
Gallium	0.07 ppm
Germanium	2.3 ppm
Gold	0.0017 ppm to 1.8 ppm
Hydrogen	29×103 ppm
Iodine	0.1 ppm to 15 ppm
Iron	5 ppm to 45 ppm
Lanthan	0.15 ppm to 0.65 ppm

Mercury	1.2 ppm to 7.6 ppm
Nickel	0.2 ppm to 6.5 ppm
Selenium	0.6 ppm to 6 ppm
Manganese	0.25 ppm to 5.7 ppm
Germanium	2.3 ppm
Barium	0.55 ppm to 4 ppm
Niobium	2.2 ppm
Tellurium	<2 ppm
Bismuth	2 ppm
Silver	0.005 ppm to 3.8 ppm
Arsenic	0.06 ppm to 3.7 ppm
Chromium	0.13 ppm to 3.6 ppm
Antimony	0.09 ppm to 3 ppm
Cadmium	0.24 ppm to 2.7 ppm
Zirconium	1.4 ppm
Gold	0.0017 ppm to 1.8 ppm
Tin	0.4 ppm to 1 ppm
Cobalt	0.2 ppm to 1 ppm
Strontium	0.05 ppm to 0.9 ppm
Lanthanum	0.15 ppm to 0.65 ppm
Rubidium	0.2 ppm to 0.5 ppm
Vanadium	0.0045 ppm to 0.5 ppm
Cerium	0.25 ppm
Molybdenum	0.06 ppm to 0.2 ppm
Gallium	0.07 ppm

um	
Lead	3 ppm to 70 ppm
Magnesium	19 ppm to 160 ppm
Manganese	0.25 ppm to 5.7 ppm
Mercury	1.2 ppm to 7.6 ppm
Molybdenum	0.06 ppm to 0.2 ppm
Nickel	0.2 ppm to 6.5 ppm
Niobium	2.2 ppm
Nitrogen	160×103 ppm
Oxygen	245×103 ppm
Phosphorus	83 ppm to 165 ppm
Potassium	150 ppm to 660 ppm
Radium	19×10-9 ppm
Rubidium	0.2 ppm to 0.5 ppm
Scandium	<0.003 ppm
Selenium	0.6 ppm to 6 ppm
Silicon	20 ppm to 2×103 ppm
Silver	0.005 ppm to 3.8 ppm
Sodium	18 ppm to 1700 ppm
Strontium	0.05 ppm to 0.9 ppm
Sulfur	42×103 ppm to 60×103 ppm
Tellurium	<2 ppm
Thallium	0.016 ppm
Thorium	<0.02 ppm
Tin	0.4 ppm to 1 ppm
Titanium	0.08 ppm to 14 pp

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Thorium	<0.02 ppm
Tungsten	0.016 ppm
Thallium	0.016 ppm
Berylliu m	0.006 ppm to 0.02 ppm
Scandium	<0.003 ppm
Uranium	0.00013 ppm
Radium	19×10-9 ppm

	m
Tungsten	0.016 ppm
Uranium	0.00013 ppm
Vanadium	0.0045 ppm to 0.5 ppm
Zinc	220 ppm
Zirconium	1.4 ppm

4.testing the hair elements

Hair Elements analysis provides information regarding recent and ongoing exposure to potentially toxic metals, especially methylmercury and arsenic, and time-averaged status of specific nutrient elements. This noninvasive screening test requires only .25 grams of hair.

5.Other elements present in the hair

Keratin is the essential component of hair. It is a protein formed by the combination of 18 **amino acids** , among which **cysteine** deserves special mention, being rich in sulphur and playing an important role in the cohesion of the hair.

It is produced by the **keratinocytes** . These cells, situated in the bottom of the dermal papilla, multiply and differentiate:

while some spread to the periphery of the hair follicle to form the internal and external epithelial sheaths, others become elongated to form the hair shaft. During this journey they fill with keratin fibres. As soon as they have filled with**keratin**, the keratinocytes die. Thus, after a journey of about 0.5 mm inside the root, the hair is definitively formed, and during the remainder of its life does not receive any further supply from the tissue which created it

Within the body of the hair, the cortex, the **keratin** is organised into protofibrils, composed of 4 chains of keratin. This assembly is held together by bonds or bridges between the atoms of the different chains. These bonds may be of variable strength: weak bonds such as **hydrogen bonds** can be distinguished from the stronger ionic bonds and sulphur bridges. It is by acting on these bonds that the shape of the hair can be modified

6. Analytes in the hair for biometric authentication

analyte name for additional clinical information, including reference ranges, specimen collection, stability and rejection criteria is discussed here.

Analyte
Aluminum; hair
Antimony; hair
Arsenic; hair

Barium; hair
Beryllium; hair
Bismuth; hair
Boron; hair
Cadmium; hair
Calcium; hair
Chromium; hair
Cobalt; hair
Copper; hair
Germanium; hair
Iodine; hair
Iron; hair
Lead; hair
Lithium; hair
Magnesium; hair
Manganese; hair
Mercury; hair
Molybdenum; hair
Nickel; hair
Phosphorus; hair
Platinum; hair

Potassium; hair
Rubidium; hair
Selenium; hair
Silver; hair
Sodium; hair
Strontium; hair
Sulfur; hair
Thallium; hair
Thorium; hair
Tin; hair
Titanium; hair
Uranium; hair
Vanadium; hair
Zinc; hair
Zirconium; hair

This test is useful for

1. Toxic Element Exposure
2. Excessive Fish Consumption
3. Alopecia
4. Depression
5. Fatigue
6. Malabsorption
7. Hypertension
8. Impaired Glucose Tolerance
9. Kidney Function
10. Parkinson's-like Symptoms
11. Sexual Impotence or Decreased Testosterone Production
12. Vision Problems

7. Advantages of hair element analysis for biometric authentication

With respect to its contained elements, hair is essentially an excretory tissue rather than a functional tissue. Hair element analysis provides important information which, in conjunction with symptoms and other laboratory values, can assist the physician with an early diagnosis of physiological disorders associated with aberrations in essential and toxic element metabolism.

As protein is synthesized in the hair follicle, elements are incorporated permanently into the hair with no further exchange or equilibration with other tissues. Scalp hair is easy to sample, and because it grows an average of one to two cm per month, it contains a "temporal record" of element metabolism and exposure to toxic elements.

Nutrient elements including magnesium, chromium, zinc, copper and selenium are obligatory co-factors for hundreds of important enzymes and also are essential for the normal functions of vitamins. The levels of these elements in hair are correlated with levels in organs and other tissues.

Toxic elements may be 200 to 300 times more highly concentrated in hair than in blood or urine. Therefore, hair is the tissue of choice for detection of recent exposure to elements such as arsenic, aluminum, cadmium, lead, antimony and mercury.

Through recent vast improvements in technology, instrumentation and application of scientific protocols, hair element analysis has become a valuable tool for providing dependable and useful data for physicians and their patients. The U.S. Environmental Protection Agency stated in a recent report that "...if hair samples are properly collected and cleaned, and analyzed by the best analytic methods, using standards and blanks as required, in a clean and reliable laboratory by experienced personnel, the data are reliable." (U.S.E.P.A. 600/4-79-049)

Hair, however, is vulnerable to external elemental contamination by means of certain shampoos, bleaches, dyes, and curing or straightening treatments. Therefore, the first step in the interpretation of a hair element report is to rule out sources of external contamination.

Hair element analysis is a valuable and inexpensive screen for physiological excess, deficiency or maldistribution of elements. It should not be considered a stand-alone diagnostic test for essential element function, and should be used in conjunction with patient symptoms and other laboratory tests. Doctor's Data offers a Hair Toxic and Essential Elements profile and a Hair Toxic Element Exposure profile containing an expanded lineup of toxic metals.

CONCLUSION

Hair elements can be measured at regular intervals and it can be taken as a biometric authentication for human being in future and this can be extend to animals also.

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