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Determination of Origin of species – A Somatoscopic Study of hair from Human and Animal origin

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Abstract:

In forensic investigation hair is the most important trace evidence, which is commonly found on the scene of the crime. With increasing crime and knowledge of various evidence type and their investigation method being spread to even a common man (population) through the advent of internet and various documentary movies in the past 5 to 6 years. The animals and are aware of ins & outs of various conventional means of identification adherence the need for conventional means of investigation to relate the criminal with the crime scene has become an unavoidable concern for investigating officer. On such unconventional means of evidence to relate the crime scene with criminal, here can be used in this study we have tried established not only the most distinguished morphological features between humans and animals hair but also explored the possibility of creating a local database to refer in accordance with case of hair samples of certain animals from certain geographical region and are formed on the person of suspect, so that the suspect can be identified or the presence of the suspect on the crime scene from detailed examination of hair sample acquired.

Keyword: *Geographical region, Morphological feature, human hair animal hair, Suspect, Crime Scene.*

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Introduction

Hair evidence is generally encountered at a scene of crime which may include deposition of hair samples on a victim, suspect or nearby area. Since the inception of technique to DNA examination, hair evidence has also become an important Avant Garde to individually was used to show the opportunity of guilt, but it could not provide produce definite proof of identity. Now hair can be investigated for DNA, which can be utilized to analyze equally a victim and a criminal.

Human hair produces out of follicles situated in the skin. The part of a hair inside a follicle is the origin, the portion that is observable over the skin is called the shaft. Respectively hair is composed of three layers. The external layer, known as the cuticle, is a distinguished layer of covering scale like cells. The internal layer, the cortex, contains of extended cells that contain pigment. The cells of the medulla, the inside layer, are several sided and in rows. When component of hair is observed under a microscope, it is possible to analyze human from animal hair.

The cuticle cells of animal hairs are bigger, less regular in shape, and features of the species. The medulla is continuous and well defined, distinct human hair, in which regularly the core cannot be distinguished or is interrupted or fragmented. Medullary Index, in which the percentage of the diameter of the medulla and the diameter of the total shaft, can also be used to help differentiate between animal and human hair. For humans, medullary index is generally less than 0.33, for animals, it is usually 0.5 or greater.

The best way to associate the hair samples besides under a comparison microscope. The forensic examiner can then aspect for a match between hairs in terms of color, length, diameter, nature of the medullas, and symbol of bleaching or coloring. In fact, then hair grows at a rate of around 1.3 centimeters per month **(Conklin, Gardner and Shortelle, 145).**

Two main types of forensic hair investigations: hair identification and hair comparison. Hair identification contains classifying a hair as being a number of specific groups a hair as existence a representative of a specific group, e.g. human pubic hair. In hair comparison, any other way, a determination is complete as to whether or not hairs of the same group are dependable with having had a mutual origin. Hair identification should be considered first since it is a required initial step in hair comparison.

Following are the points or elements are to be considered when conducting examination of hair.

1. The questioned hair- the hair sample procure from the scene of crime and under examination.

2. A standard reference collection- the hair samples collected from the victim accused and any other possible sources of hair at the scene of crime or the people, victim has come in contact after the crime.

3. Literature references including published photo micrographs and keys- the databases composed by referencing to a large number of researches and experiments conducted and published in publication of international repute.

4. The equipment used- the various optical examination tool such as microscope and graduated slides as well as equipment used for preservation of the sample

5. The list of hair characteristics- various features such as pigment color, pigment distribution, medullary index etc.

6. The examiner- Forensic expert or investigator assigned to the investigation. Chain, changing aspects and pest control **(Andrade *et al.*, 457-463).**

Difference between Human hair and Animal hair:

With hair description, it can be determined whether a hair is animal or human the following are some of the unique features.

- Diameter- Human hairs are generally, the range is 0.05-0.15mm, animal hairs can be thinner or coarser.

- Length- Human scalp hairs are extended than most animal hairs.

- Color- Animal hairs have a stripy appearance; whole human hairs never prepare.

- Medulla- Animal hairs have a compound regular/symmetrical cellular medulla, human hairs have only a shapeless medullary structure.

- Medullary index- Diameter of the medulla/diameter of the shaft hair i.e. the ratio of the medullary index.

- Shaft- Animal hairs shapes shows dissimilarity from the human hair, e.g. the spatulate form found in rodent hairs.

- Pigment distribution- Animal hairs can have pigment isolated about the medulla while this is extremely rare in humans.

- Root- In animal hairs can have diversities of root shapes, naturally brush like structure, while humans are ribbon or bulb like structure.

- Tip- Human hairs (particularly scalp) are generally frayed or cut from the tip, animal hairs are generally naturally elongated.

- Scales- Human hair only displays unequal annular scale patterns, and then the other side, animal hairs have a diversity of forms and can have more than one type in the same hair.

Description of the Animal hair and Human hair:

Human scalp hairs incline to be long with equally constant diameters and cut tips. They can appearance evidence of treatment. Pubic hairs are usually curly with wide differences in diameter. Their tips are commonly rounded or frayed from impression on clothing. Maximum beard hairs are broad in diameter, with trilateral cross-sections. Eyelash, eyebrow, nasal hairs tend to be short and thick, narrowing to an abrupt point. The remaining hairs on the human bodies are generally blurry from each other and are convened together as general body hairs. It should be recollected that hairs on the edge of various body regions will show combination features, thereby making them difficult to classify **(Siegel, Saukko, Knupeer, 1034-1037).**

Identification of the animal hairs in the scene of the crime can show the physical contact between victim and suspect or to the scene of crime may happen when the committee is a pet owner or when the crime was committed in a place where animal was kept such as barns, basement, transport vehicle. Here the parameter of differentiation is taken on the basis of their medullary index (Negi et al., 34-36). In forensic investigation, the identification of the animal hair is providing beneficial information at scene of crime. Many features of animal species can be done based on morphology of animal remains, bone and particularly hair **(Ahmed, Ali and Ghallab, 663-670).**

Morphological features of hair for comparison:

Measurable hair examination is a similar natural order grounded in science, histology, life structures, and humanities. Not with standing natural procedures, consequent treatment of the hair and incidental changes because of the person's condition make additional measurements helpful for examination. In this way, for the starting, scientific hair examiners have focused on certain tiny highlights, qualities and attributes for both human and creature hairs that have been appeared, communitarian research and aggregate involvement, to be helpful for examination in light of the fact that these attributes successfully recognize one individual from others and one populace from another. For human hairs, these attributes can be extensively gathered into structure, shading and treatment. Shaft, hair shading, medulla and scales describe creature hairs.

Color- The shade of the hair relies upon its color, surface, transparency and reflectivity. A scope of the hues in the model is normal and an immediate correlation is necessary between the addressed hair

and the realized hair so as to distinguish inconspicuous contrasts. The sum and dissemination of color inside the cortex ought to be analyzed at high magnification (200-600x). Shading is likely the most helpful trademark for examination.

Structure- The breadth, medullation, cross-area, cortical fusi and spatial setup mirror the hair's structure. The diameter can be estimated and the medullation can be described by the different plans. The spatial setup alludes to the appearance of the hair as it lies, unconfined, on a surface and relies upon the cross-sectional shape (Siegel, Saukko, Knupeer, 1003).

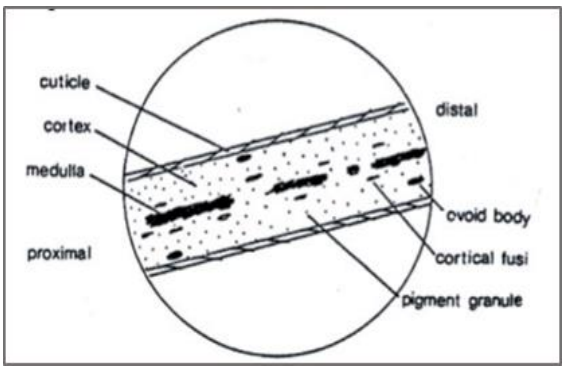

Figure: Microscopic examination of the Hair

Review of Literature

Ahmed, Ali and Ghallab (2018), discussed about the in this study the author has tried to lay down or create guidelines for local reference database in the area of Upper Egypt. For this purpose, animals native to Upper Egypt were selected for hair sample collection, they divided these animals as follow: Large ruminants (Buffalo, Camel, and Cow), Small ruminants (Got, Sheep), Equine ruminants (Donkey, Horse) and Canine ruminants (Dog, Cat). The bases of their database were cuticle scale pattern, medulla type and diameter unique feature to each criminal species & pigmentation through critical observation the found that the cuticles scale pattern of donkey is different from all other animals which is coronal pattern while other animals exhibited imbricate cuticle scale pattern. It was also observed that margin type of cuticle scales its shape, the distance in among is unique for each identified animal species and the hair medulla show consistency or exhibited continuous pattern in all the animals except sheep. In which detected pattern was fragmented medulla, medullary, diameter and margin differ concede to the species granules and like pigmentation is exhibited by camel and buffalo, while other did not indicate any pigmentation.

Chauhan, Tyagi and Shukla (2018), conducted that the study was accomplish to ascertain the existence of medulla in the young Jaat residents of Western, Uttar Pradesh. They were collected hairs samples between the age of twenty to fifty years along with the males and females. They concluded, in 61.80% of teenagers the medulla was absent, although it was splitting in 19.50%. It is used for the aim investigation or to infer the origin of the suspect or to establish the age of suspect which is involve in crime. It is also observed that the many features of hair such as medullary index, nature of medulla, nature of tip and roof, scale pattern etc. and can play a significant role in forensic inspection and comparison of hair sample which is present on the scene of crime.

MA and Humrich (2017), conducted this study in order to examine how frequent the occurring of hair belonging to canine and feline domestic species in motor vehicle are in the area of Lincoln, Nebraska and propose a method to we relate the crime scene with a suspect. They divided their study in two parts 1. Distribution of hairs in vehicle owned by pet owners and 2. Distribution of hairs in vehicle owned by non-pet owners as cat and dogs have been deemed as the most common pets to have in a house. The result show that there are no significant differences between distribution of dog and cat hair in vehicle of pet owner and non-pet owner, and hence these artefacts cannot successfully corroborate to the convict the suspect.

Negi et al. (2017), observed with the experiment conducted to verify differences between different species of dog, cat buffalo, and cow found in local Village of Palam Vihar, Gurugram, Haryana, India to establish the feasibility of crime scene in a barn or any other place where the presence of such animal is

established like a pet in house etc., they have done so with the help of calculating medullary index of above species. From their study It is proved that different species, be it adult or baby have different medullary indices, which can be used to relate a suspect with the crime scene.

Khan et al. (2014), discussed about the analysis of cuticle thickness, cuticle inner margin and ovoid **bodies** (present or absent). They were preferred four different castes such as Awan, Butt, Gujjar, and Rajput to analyze the differences and similarities. In this study, the compound microscope was also used for the analysis of the hair samples. It concludes that study was to establish the database through analyzing the inner cuticle margin, ovoid bodies and cuticle thickness in human hair in relation to the crime scene examination. This study counted the hair parameters along with that valuable parameter to give significant result can be recommended to be involved in forensic investigation.

Kshirsagar, Singh and Fulari (2009), discussed about the fact there is an inherent difference between of the diameter and shaft of the hair. They were collected hairs sample from different species of the animal hair as well as different part of hair from the body. They conclude that the medullary index was less in human hair and more in animal hair. These parameters such as diameter of the shaft hair, diameter of the medulla and medullary index most important for the comparison between the animal and human hair. These discoveries concluded that the hair sample in any portion of the body prove i.e. good physical evidence in crime investigation.

Conclusion

From the present study it is concluded that it is not only possible to differentiate between animal and human hair from there medullary index but also from cuticle pattern, color, pigment, distribution, geographical area and race. It is inferred that even through humans have medullary index was less than 0.25 and animal hair 0.44, which is the most distinguish feature to be looked upon when conducting or determining the origin of human hair as well as animal hair. It is also observed that the maximum diameter of medulla is 20 µm in human and least diameter of medulla in animal is also 20 µm, which renders the differentiation between animals and human hair sample in effective on the basses of the medulla's diameter. Further this study is also observed that, hair can not only be used established the origin of species but also can be employed to determine the colour treatment, geographical region, chemical composition, habits, growth stage, medical history and various other feature which can be of use in profiling the criminal or individualising the suspect, Especially in the serological examination, a local database can prepare so that if in an area a crime has occurred near by places which have barns and stables this database can be used a connection between the suspect and scene of crime..

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