Trace Evidence – Hair Lab #1

Hair is a common form of trace evidence often used by forensic investigators. Normally it is circumstantial or indirect evidence and must be used in connection with other types of evidence and clues to help solve a crime. The forensic scientist looks for several characteristics when examining hair. These include color (pigments), cuticular scales, shape of medulla and the medullary index. Also, he/she may need to determine whether the hair is human or animal and what part of the body the hair came from (head, face, eyebrow, eyelash, armpit, chest, leg, arm or pubic area).

Hair can be used forensically in many ways. Even though the evidence is circumstantial, hair can be used to link a suspect to a crime scene. It can indicate where a criminal entered or exited an area. It can be used to show that a suspect had contact with a victim. It can help identify shoes or clothing associated with a suspect.

Hair Anatomy

Humans as well as most other mammals have bodies covered with hair. In many mammals, relatively thick hair covers the entire body and helps to retain body heat. Hair is an appendage that grows from a hair follicle out through the skin. The hair begins at the bulb (root), continues into the hair shaft and ends with the tip. (See Figure 1) Associated with each hair is a sebaceous gland that produces sebum, an oily substance that lubricates the hair and skin. Also a tiny muscle, the arrector pili, is attached to the hair follicle. When this muscle contracts, the hair “stands on end.” This phenomenon is often called “goose bumps.”
When examined under a microscope, a hair shows several parts. Easily seen are the cuticle, the cortex and the medulla. (See Figure 2) The cuticle is the tough outer layer of the hair shaft. Often this layer shows a scale pattern when viewed with a microscope.

![Figure 2: Hair Structure](image)

The cortex gives the hair its shape. The pigments that are responsible for hair color are found in the cortex. The color, shape and distribution of pigment granules are important when making comparisons of hairs.

The medulla runs down the middle of the cortex, appearing as a central canal. In some mammals the medulla occupies more than half of the hair’s diameter. Not all hairs have a medulla but, if present, there are three types of medulla patterns: continuous, interrupted, and fragmented. (See Figure 3) If there is no medulla, the pattern is described as absent. The presence or appearance of the medulla varies from person to person and even between the hairs of a single individual. Human head hairs generally have no medulla or have fragmented ones. Rarely do they show a continuous pattern. An important exception is shown in the Asian races, whose head hairs usually have continuous medullas. Most animals have medullas that are continuous or interrupted.

![Figure 3: Medulla Patterns](image)
Another feature of the medulla that aids in classification or identification is the medullary index. This is determined by calculating as follows:

\[
\frac{\text{diameter of medulla}}{\text{diameter of hair}} = \text{medullary index}
\]

If the hair diameter is 8 and the diameter of the medulla is 2, then you would have

\[
\frac{2}{8} = .25
\]

Investigating Hair

PART A: Examining Human Hairs

1. Place a drop of water in the center of a clean microscope slide. Pull out one of your head hairs and mount it in the drop of water. Add a cover slip. Examine carefully under 100X and 430X. Try to find as many parts of the hair as you can. On Data Sheet 1, make a detailed colored drawing of the hair. Label completely and provide a complete description of the hair characteristics.

2. Repeat the observation, drawing, and description using a different colored hair from another student in the class.

3. Repeat the observation, drawing, and description using a hair that has been bleached or dyed. In your descriptions, note any observable similarities between this hair and an unbleached hair.

4. Repeat the observations using three more hairs from other parts of your body. In your descriptions, list the similarities and differences you observe between the microscopic characteristics of the hairs from different areas.

PART B: Examining Animal Hairs

1. Obtain animal slides from four different animals. Examine carefully each under 100X and 430X. Try to find as many parts of the hair as you can. On Data Sheet 2, make detailed
colored drawings of each hair. Label completely and provide a complete description of the hair characteristics. In your descriptions, note any similarities between the hairs as well as any distinguishing features of each particular hair.

**PART C: Examining and Comparing Cuticular Scale Patterns**

There is little value in examining cuticular scale patterns to compare human hairs, but the patterns are useful in distinguishing many animal pairs. For this part of the investigation, you will choose one of the animal hairs available. Each student in the class should select a different species.

1. Select the animal hair you wish to examine.
2. Examine with the microscope under 100X and 430X.
3. Make a drawing and complete description of the scale pattern on Data Sheet 3.
4. Exchange your slide with those of three other persons and repeat the procedure. Make drawings and descriptions. In your descriptions, point out similarities and differences between the four animal hairs.

**Lab Write-up**

Your lab report on this investigation will be the answers to the following questions and the three data sheets (attached, in order, to the back of the discussion page[s]). Write out the question and answer each one accurately and completely. All work must be typed on the discussion page(s).

1. What physical characteristics of hair did you use to help distinguish one type from another? Support with specific examples from your observations.
2. Explain why hair is considered *circumstantial* evidence instead of a positive means of identification as fingerprints are.
3. Even though considered circumstantial, why is hair considered important evidence? Give examples to support your point.
4. What differences did you find between human and animal hairs?
5. What have you learned about hair that you did not know before? Be specific.
6. How can you apply what you have learned from this investigation to a criminal investigation? Be specific and support your answer with clear examples.
## DATA SHEET 1: HUMAN HAIRS

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DATA SHEET 2: ANIMAL HAIRS

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Figure 1:
## DATA SHEET 3: CUTICULAR SCALE PATTERNS

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