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Hair Analysis
Part Two

You have been given four envelopes containing hairs from each suspect's body and clothing as well as hairs found at the crime scene. The envelopes with hairs from the suspects are labeled with letters only (suspect A, suspect B, and suspect C), so that you do not know the identity of the contents. The envelope with hairs from the crime scene is labeled evidence. Your job is to examine the samples in each envelope and compare them. If any of the samples match, it could link one of the suspects to the crime scene. Follow the steps below to complete your analysis. You may wish to split up the work within your team by having one person analyze the evidence envelope, one person envelope A, etc.

1.) Label a set of slides for each envelope with the envelope's letter and the packet number (if there is more than one packet per envelope). The number of packets contained within the envelope will be written on the outside. *You must examine each packet.*

Ex:

> **A**
> *packet #1*

2.) Open envelope A. Open the first packet and remove one or two hairs.

3.) Measure the length of the hair in millimeters.

4.) Make a wet mount of each hair using your labeled slides.
> a.) Place a small drop of water on the center of the slide.
> b.) Place the appropriate hair in the drop of water so that the hair lies flat on the slide. Cut a small (I cm) length of hair if necessary.
> c.) Cover the hair and water drop with a cover slip.

Ex:

> **A**
> *hair #1*
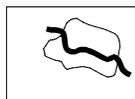
4.) Examine each slide under the microscope at high power. Fill out the data sheet on each hair. You may add criteria of your own to the data sheet in the blanks provided. Refer to the handout on hair identification for help with terms.

5.) Repeat steps 2-4 with the remaining packets in each of the envelopes.

6.) Compare data sheets. Are there any packets containing hairs that appear to match hairs from the evidence envelope? Which ones?

Why would you say they are a match?

Think about what an apparent match would mean in terms of evidence. How would you report your results to the district attorney or to a jury?

Hair analysis data

Label:_____   **Date:**_____

Hair characteristics

length (mm)	
color	
condition of root (bulbous, narrow, rounded, pointed, attached bits of skin, etc.)	
condition of tip (frayed, smooth, bent, split, etc.)	
width (if microscope is fitted with a micrometer)	
cuticle scales (flat and smooth, protruding, spikey, etc.)	
medulla (present/absent, broken/continuous, thick/thin)	
width of medulla (If microscope is fitted with a micrometer, give exact measurement. If no micrometer, estimate the proportion of the width that is taken up by the medulla, e.g. 1/4, 1/2, 3/4, etc.)	
possible species identity (compare to type collection)	

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Hair Analysis

Guide to Identification

Unfortunately, hair is not the best type of physical evidence for establishing identity. It is not possible to show with any certainty that two hairs came from the same person or animal. However, hair can be used to rule out certain suspects or scenarios. It can also be used to corroborate (support) other physical evidence if it is consistent with the rest of the evidence.

How is hair analyzed?

The simplest method of identification is visual observation with the naked eye, which can indicate color, length, and amount of curl.

Hair can also be examined microscopically to reveal characteristics of its physical structure. Hair is composed of three principal parts:

cuticle – outer coating composed of overlapping scales
medulla – central core, which may be absent
cortex – protein-rich structure surrounding
the medulla; contains pigment

cortex   cuticle   medulla
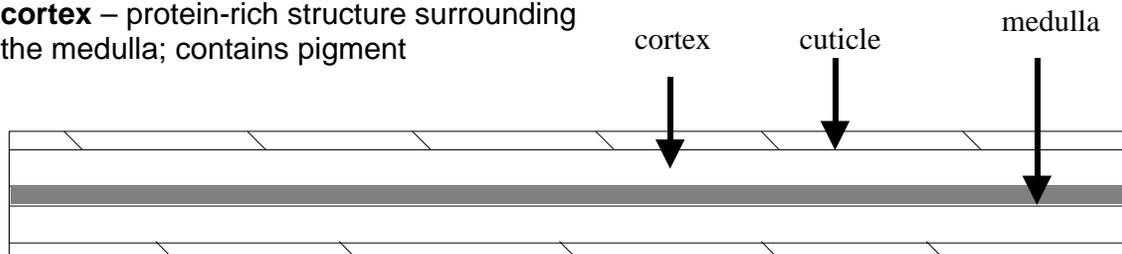
The structure of hair has been compared to that of a pencil with the medulla being the lead, the cortex being the wood and the cuticle being the paint on the outside.

Cuticle: The scales of the cuticle may vary in how many there are per unit of measure, how much they overlap, their overall shape, and how much they protrude from the surface. The thickness of the cuticle may vary as well, and the cuticles of some species' hairs may contain pigment. Characteristics of the cuticle may be important in distinguishing between hairs of different species but are often not useful in distinguishing between different people.

Medulla: The medulla may vary in thickness, continuity (one continuous structure or broken into pieces), and opacity (how much light is able to pass through it). It may also be absent. Like the cuticle, the medulla can be important for distinguishing between hairs of different species, but often does not lend much important information to the differentiation between hairs from different people.

continuous medulla

broken medulla

Cortex: The cortex varies in thickness, texture, and color and distribution of pigments. The cortex is perhaps the most important component in determining from which individual a human hair may have come.

Microscopic examination can also reveal the condition and shape of the root and tip.

Biology of Hair

Hair is an outgrowth of the skin and is produced from a structure called the **hair follicle**. Humans develop hair follicles during fetal development, and no new follicles are produced after birth. Hair is composed of the protein **keratin**. Keratin is also the primary component of finger and toe nails.

Hair color is mostly the result of **pigments** -- chemical compounds which reflect certain wavelengths of visible light. There are two main pigments found in human hair: eumelanin, which gives color to brown or black hair and pheomelanin, which produces the color in blonde or red hair. Hair color may also be influenced by the optical effects of light reflecting and bouncing off the surfaces of the different hair layers.

Hair shape (round or oval cross-section) and texture (curly or straight) is influenced heavily by genes. However, nutritional status and intentional alteration (heat curling, "perms") can affect the physical appearance of hair.

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