



Hairs & Fibers

Glue the paper on page 19
under the notes
FAF Right

<http://media.popularmechanics.com/images/PMX0706FORENSICSHairSmall.jpg> Presentation developed by T. Tomm 2006 <http://sciencespot.net/>

Locard's Exchange Principle

"Every Contact Leaves a Trace"

The value of trace (or contact) forensic evidence was first recognized by Edmund Locard in 1910. He was the director of the very first crime laboratory in existence, located in Lyon, France.



The Locard's Exchange Principle states that "with contact between two items, there will be an exchange." For example, burglars will leave traces of their presence behind and will also take traces with them. They may leave hairs from their body or fibers from their clothing behind and they may take carpet fibers away with them.



Source: http://www.virtualsciencefair.org/2004/fren4j0/public_html/trace_evidence.htm

Biology of Hair



Hair is composed of the protein **keratin**, which is also the primary component of finger and toe **nails**. Hair 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 color is mostly the result of **pigments**, which are chemical compounds that reflect certain wavelengths of visible light. Hair **shape** (round or oval) and **texture** (curly or straight) is influenced heavily by **genes**. The physical appearance of hair can be affected by **nutritional** status and intentional **alteration** (heat curling, perms, straightening, etc.).

In order to test hair evidence for nuclear DNA, the **root** must be present. Hair may also be tested for **mitochondrial** DNA, or DNA that is found in the mitochondria of our cells.

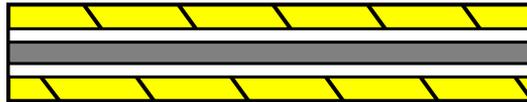
NOTE: Hair that normally falls out does not have a root attached, while hair that is pulled out by force does.



Sources: http://library.thinkquest.org/04oct/00206/lesson.htm#_hair & [http://www.fbi.gov/hq/lab/fsc/backissu/july2000/deedric1.htm#Index%20\(Hairs\)](http://www.fbi.gov/hq/lab/fsc/backissu/july2000/deedric1.htm#Index%20(Hairs))

Image: <https://dps.mn.gov/divisions/bca/bca-divisions/forensic-science/Pages/trace-hair.aspx>

Hair Structure

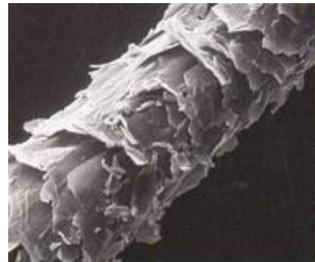


Cuticle

Outer coating composed of overlapping scales

The cuticle varies in:

- Its **scales**,
 - How many there are per centimeter,
 - How much they overlap,
 - Their overall shape, and
 - How much they protrude from the surface
- Its **thickness**, and
- Whether or not it contains **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**.

Info: http://library.thinkquest.org/04oct/00206/lesson.htm#_hair

Image: <http://www.hairdressersus.com/micro/Image5b.jpg>

Hair Structure

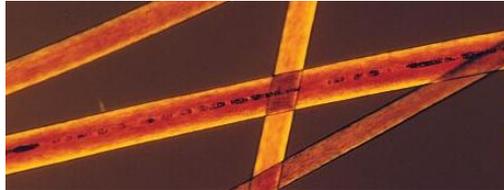


Cortex

Protein-rich structure around the medulla that contains pigment

The cortex varies in:

- **Thickness**
- **Texture**
- **Color**



- Distribution of 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**.

Info: http://library.thinkquest.org/04oct/00206/lesson.htm#t_hair

Image: <http://www.extrapersonality.com/hair.html>

Hair Structure



Medulla

Central core (may not be present in all hair samples)

The medulla may vary in:

- **Thickness**
- **Continuity** - one continuous structure or broken into pieces
- **Opacity** - how much light is able to pass through it



Figure 3. Light micrographs of three human hairs. The left example illustrates dark hair with a typical fragmentary medulla. The middle hair is blond and has no medulla. The right colored hair is white with a continuous medulla.

- It may also be **absent** in some species.

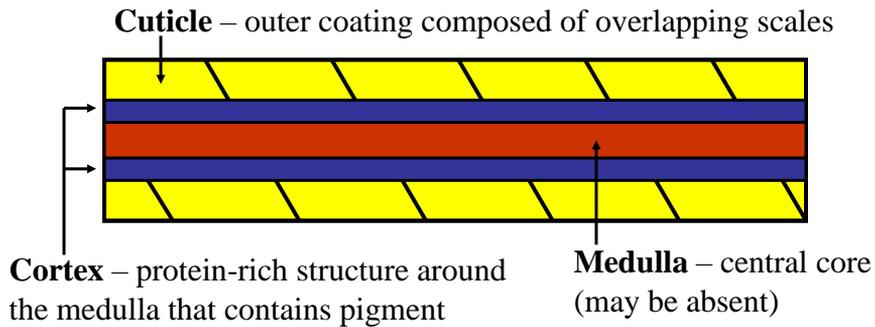


Like the cuticle, the medulla can be important for distinguishing between hairs of different **species**, but often does not lend much important information to the differentiation between hairs from different **people**.

http://library.thinkquest.org/04oct/00206/lesson.htm#t_hair

<http://www.bfro.net/images/whatis/figures/Fig.%203%20with%20caption.jpg>

Hair Structure = Pencil



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

http://library.thinkquest.org/04oct/00206/lesson.htm#_hair

Let's take a closer look ...

- 1- Get a plastic sheet from your teacher.
- 2 – Pull out a strand (or 2) of hair and place it inside the plastic sheet.
- 3 - Have it laminated by the teacher
- 4 - Write your name on it.
- 5 - Use a microscope to examine your hair sample. Change the powers of magnification (low → medium → high) and use the focus to observe the different layers of hair and the root.
- 6 – Compare your hair sample to those of your classmates.



Done? STAPLE OR TAPE the “slide” in your notebook on page 19.

Turn in your HDSN to the correct place!

How does your hair compare?

7. Make a "slide" using one of your hairs. Tape it to the page under this worksheet AFTER you examine it under a microscope.

8. Examine the animals hairs provided by your teacher. Draw a sketch of each one under MEDIUM or HIGH power on the page under this worksheet.

9. How does your hair compare to other animal hairs? Give at least 3 comparisons.

(1) _____

(2) _____

(3) _____