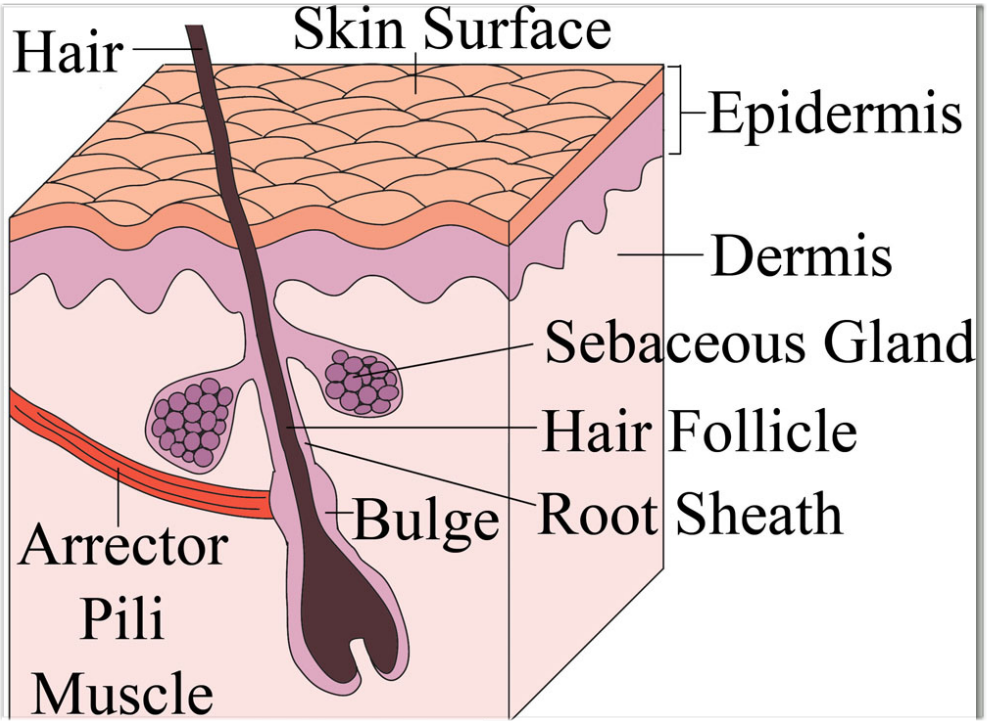
HAIR AND FIBER

Hair is encountered as physical evidence in a wide variety of crimes. A review of the forensic aspects of hair examination must start with the observation that it is often difficult to individualize a human hair to a single head or body. If a hair is forcibly removed in such a way to leave some blood or skin with the root, then DNA typing can be performed. There are also some new techniques which allow DNA typing to be performed without a root, if enough samples of hair are found.

In the absence of a root with skin or blood, or a sufficient sample of hairs, color and structure (morphology) is the most characteristic forensic feature of hair. If hair is properly collected at a crime scene and accompanied by an adequate number of control hairs, it can provide strong corroborative evidence for placing an individual at a crime site.

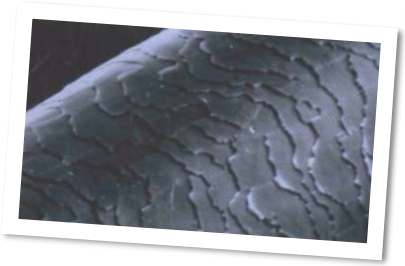
Hairs can also give assistance by giving clues as to how a hair came to be removed from its source. It is quite easy to distinguish between hairs that have been forcibly removed, cut, or have simply fallen out.

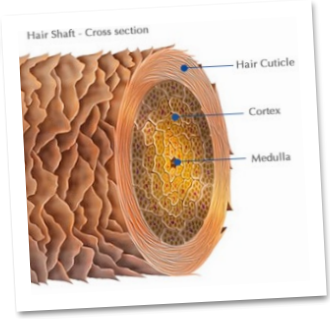


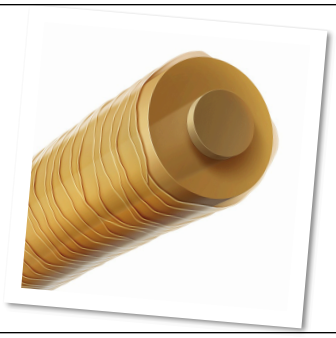
Hair can grow on all parts of the body except your palms and the soles of your feet.

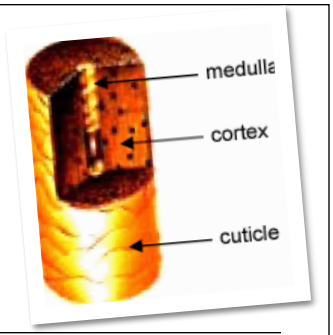
Red hair does not turn gray, instead it turns sandy, then white.

Hair grows faster in warm weather.



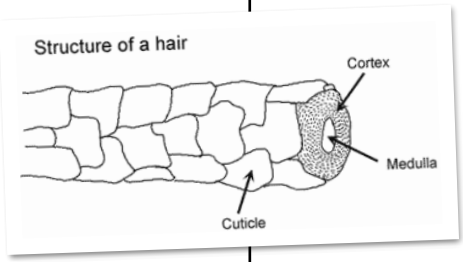


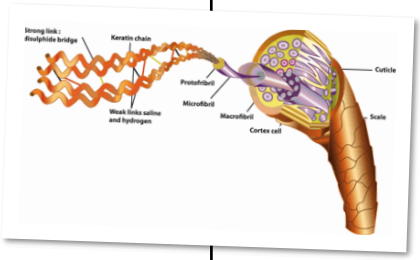


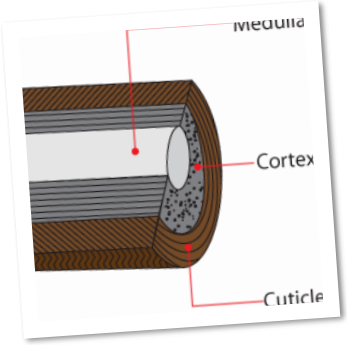


Hair is an appendage of the skin that grows out of a structure known as the hair follicle. The length of a hair extends from the root embedded in the follicle, continues into a shaft, and terminates at the tip. The shaft itself, which is composed of cuticle, cortex, and medulla, is subjected to the most intense examination by the forensic scientist. Most hair observations, with the exception of the cuticle, can be performed with a simple microscope. Two of the features that make hair a good subject for establishing individual identity are its resistance to chemical decomposition and its ability to retain structural features over a long period of time. Much of this resistance and stability is attributed to the cuticle or outside covering of the hair. The **cuticle** is formed by overlapping scales that always point toward the tip of the hair. The scales are formed from special cells that have hardened and flattened while progressing from the follicle.

Contained within the protective layer of the cuticle is the cortex. The **cortex** is the interior of the hair, which is composed of spindle-shaped cortical cells aligned in a regular array, parallel to the length of the hair. The cortex derives its forensic importance from the fact that it is embedded with pigment granules that impart color to hair. It is the color, shape, and distribution of these granules that provide points of comparison between the hairs of different samples. The features of the cortex are examined microscopically after a hair has been placed on a slide with a couple of drops of water and a cover slip. The **medulla** is a collection of cells which appear as a canal running though the center of the hair. In many animals, the medulla is the most predominant feature, sometimes spanning more than half of a hair's diameter. The medullary index is an estimate of the width of the hair taken up by the medulla; it is usually expressed as a fraction. The index generally has a value less than 1/3 for humans; for most other animals the value is 1/2 or greater. Not all human hairs have a medulla. When present, the appearance of the medulla varies slightly between a single individual's hairs.







Blond people have the most hair on their head - around 120,000 strands, redheads have the least at 80,000.

Hairs are continually shed and regrown at a rate of about 100 each 24 hours.

Upon finding hair at a crime scene, the first thing to be done is an examination in a crime laboratory to establish whether the hair originates from a human or animal. A careful microscopic examination of hair will reveal morphological features that can distinguish human hair from that of animal hair. There are also several different possible shapes of hair. Hair can be straight, curly, or kinky, depending on whether the cross section of the hair is round, oval, or crescent shaped. It is risky to assign racial characteristics to hair evidence, but generally, hairs found in Asian and Native Americans have a round cross section and no twisting. Mexicans, and people of Middle Eastern background show an oval cross section, rarely twist or undulate with evenly distributed pigmentation. People of African heritage have hair characteristics that include a flat to crescent- shaped cross section with a twist or undulation and dense pigmentation.

It is also possible to determine whether a hair has been pulled out or fallen out. A hair that has been forcibly removed will have parts of the roots attached. A hair that has fallen out will have a smooth root.

Hair can collect materials that come into the body and are delivered by the blood to the hair root, where they are deposited in the cortex. As analytical testing methods have become more sensitive and efficient, many drugs and their chemical make-ups can be detected in just a few millimeters of hair. Drug analysis of hair backs up standard blood and urine tests because drugs are typically filtered from blood within a

few hours. Analysis of urine can detect drug metabolites for a period of three to five days. But using hair to detect drug consumption can be traced over extended periods of time.

Hair grows at a rate of about 5mm per day. By analyzing bits of hair, continuous or infrequent use of drugs can be discovered and even matched to an approximate time line, such as every week, or every month.

Further, a hair's cuticle is typically coated with scalp oils, so investigators can sometimes find traces of a person's environment embedded externally in hair. Scientist have detected smoke from crack cocaine this way, as well as heavy metal industrial pollutants, such as cadmium. Because of this, someone who has not smoked crack or been deliberately poisoned may show a false positive just by being in the presence of drug users.

Finally, there is DNA found in the roots of hair. This DNA can be isolated and amplified, which can then be provided as information in identification of individuals. Unknown hairs can be compared to known individuals by comparing DNA which can then be used with a higher degree of certainty.

We can learn a great deal of information from hair:

1. whether its animal or human
2. racial origin
3. location from body source
4. identity using DNA
5. diet and possible drug use

FIBERS

Fibers are ubiquitous in our society, and are found everywhere from clothing, to furniture, to linens in the carpet of a car. They are a form of trace evidence, which is small and easily transferred, and thus of value in crime scenes. There are several reasons why fibers are a useful form of evidence: 1. they are easily transferred, 2. they are capable of multiple transfers (thus illustrating a series of events), 3. they vary depending on their specific end use (i.e., carpet fibers, which need to be more durable, are different from clothing fibers), and 4. they exist in a huge variety.

Despite this, fibers have two drawbacks: a. it is hard to quantify rarity of fibers, as no real studies have been done, and 2. fibers are most often class evidence, thus not leading to a specific person.

The type (i.e., natural, synthetic, or a blend) is the most important characteristic of fiber. Natural fibers, as they have their origin in plants and animals, will look rough, whereas synthetic fibers will typically be smooth.

Fiber Evidence

By definition, a fiber is the smallest unit of a material that has a length many times greater than its diameter. It can be spun with other fibers to form a yarn that can then be woven or knitted to form a fabric. Natural fibers are derived entirely from plant or animal sources. The most commonly encountered plant-derived fibers include cotton, hemp, linen, and jute. Whereas the most frequently encountered animal-derived fibers are wool, silk, cashmere, and fur. Synthetic fibers comprise more than half of all fibers used in the production of textile materials. The most commonly encountered man-made fibers are polyester, nylon, acrylic, and rayon. These types of fibers can be readily distinguished from animal fibers in that they have no medulla or scale patterns when observed under a microscope. How a fabric is constructed affects the number and types of fibers that may be transferred during contact. Tightly woven or knitted fabrics shed less often than loosely knit or woven fabrics. The make-up of a fabric also determines whether or not it will burn or simply melt when exposed to flames. Finally, certain fabrics also exhibit different types of odors which further enable investigators to determine its type and possibly its source.