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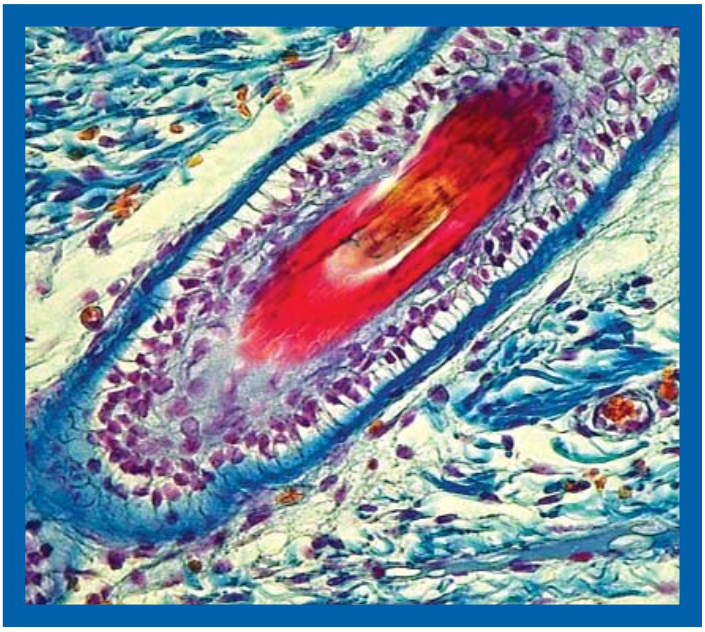
SPLITTING HAIRS



In every struggle between an attacker and a victim, hairs, fibers, and other minute pieces of evidence are transferred from one to the other. This type of evidence is found at crime scenes and on victims and it can be used to link a suspect or a suspect's belongings to the crime. Hair is a very important clue for investigators because aside from burning, it is practically indestructible. Scientists are able to examine hair that has been collected from objects at the crime scene and from bodies, even severely decomposed bodies, to uncover clues to the crime.

The Composition of Hair

Hair is a combination of protein substances, but is comprised primarily of keratin, a strong structural protein. Hair follicles in the skin produce a hair for a certain period of time, usually many months, before the hair falls out and a new one starts to grow. Head hair grows about 2.5mm per week while facial hair grows faster and body hair more slowly. Contrary to the popular myth, hair does stop growing at death. It's the shrinking of the skin after death that gives the effect of the hair having continued to grow, especially the facial hair.

A hair shaft has three layers: the cuticle, the cortex, and the medulla. The tough outer layer, called the cuticle, is comprised of overlapping scales that protect the inner layers. Examination of these scales under a microscope gives a quick indicator of whether the hair came from an animal or human—the scales look very different in animal hair.

Below the cuticle is the cortex. This layer is comprised of spindle-shaped cells that give the hair its texture and house the pigment that gives hair its distinct color. The distribution of this pigment can be used to determne if a hair is likely to have come from a specific individual.

The innermost layer is a hollow tube called the medulla. The physical appearance of the medulla has many variations, it can be continuous, fragmented, or even absent from a hair sample. Human hair usually has a fragmented or absent medulla except for Asian people whose hair has a continuous medulla. The medulla can look different in two hairs taken from the same person, even if it came from the same area of the body. Animal hair generally has thicker medulla and cortex layers than human hair because it is an important means of insulation and protection for the animal.

What Hair Can Tell Us

Microscopic forensic analysis of hair focuses on hair color and structure. If a hair sample includes the root structure, its examination can indicate if the hair fell out naturally or was forcefully removed as might happen during a struggle. An intact sample with the root can also give a good determination of the full length of the hair. As discussed above, hair analysis can determine whether the hair came from a human or animal, and if human, can indicate if the source is a member of a particular race. Scientists can also determine if the hair has been dyed, cut in a certain way, and what part of the body it came from.

Hair can be examined under a light microscope and compared to reference samples or samples from a suspect. For this type of comparison, the hair is typically dry mounted on a glass microscope slide and viewed under a comparison microscope. It can also be embedded in a wax block and sliced in a microtome to produce wafer-thin sections that are then mounted on glass slides. This allows the scientists to examine the cross-sectioned shape of the medulla. Occasionally, pattern impressions of the scales of the cortex are preserved in cellulose acetate for more detailed study. A variety of tests are available to the forensic scientist for examining hair that has been dyed and for examining hair for age.

Hair's absorbent properties make it an important tool in assessing deaths from poison or drugs. But, it could takes weeks for a hair sample to indicate the presence of a toxic substance so while it's not a good indicator of exposure to toxins within the past few days, it can be an excellent indicator of long-term exposure or
drug abuse.

A technique called neutron activation analysis, introduced in the 1950s, is one of the methods used to identify toxins in hair samples. Hair samples are bombarded with neutrons that collide with trace elements in the sample and cause them to emit gamma radiation. The levels of radiation emitted are compared to known reference levels and allow scientists to measure every constituent part of the sample. The technique is not limited by small sample size and a single hair can realistically yield results for up to 14 different elements. It was first used in a 1958 murder case to determine that hair found clasped in the victim's hand came from the suspect. The ratio of sulphur radiation to phosphorus radiation emitted by the sample was found to be consistent with a sample taken from the suspect, thus connecting him to the crime.

A Maturing Science

Forensic hair analysis isn't a new technique. One of the earliest scientific papers on the subject was published in 1857 in France and by the early 1900s microscopic examination of hair was well established. In 1931 Professor John Glaister published a paper titled Hairs of Mammalia from the Medico-legal Aspect, which was considered a standard reference work thereafter.

As forensic science advances with computers and increasingly more accurate means of detecting the component parts of small samples, trace evidence may soon play even more significant roles. A hair sample with the root or other tissue attached to it can now offer genetic information such as blood type or a person's genetic makeup. Even if the root isn't present in a sample, mitochondrial DNA analysis can still provide information useful to the case. Both of these methods of DNA analysis are currently used to provide DNA evidence for criminal and paternity cases.

But, positive identification cannot reliably rest on hair evidence alone. The best that a forensic scientist can do is present scientific evidence that a crime scene sample is consistent with a suspect. And while it can't be the proverbial smoking gun, it can be used to exclude a suspect based on race and where it can't exclude, it can provide valuable corroborating evidence of guilt.

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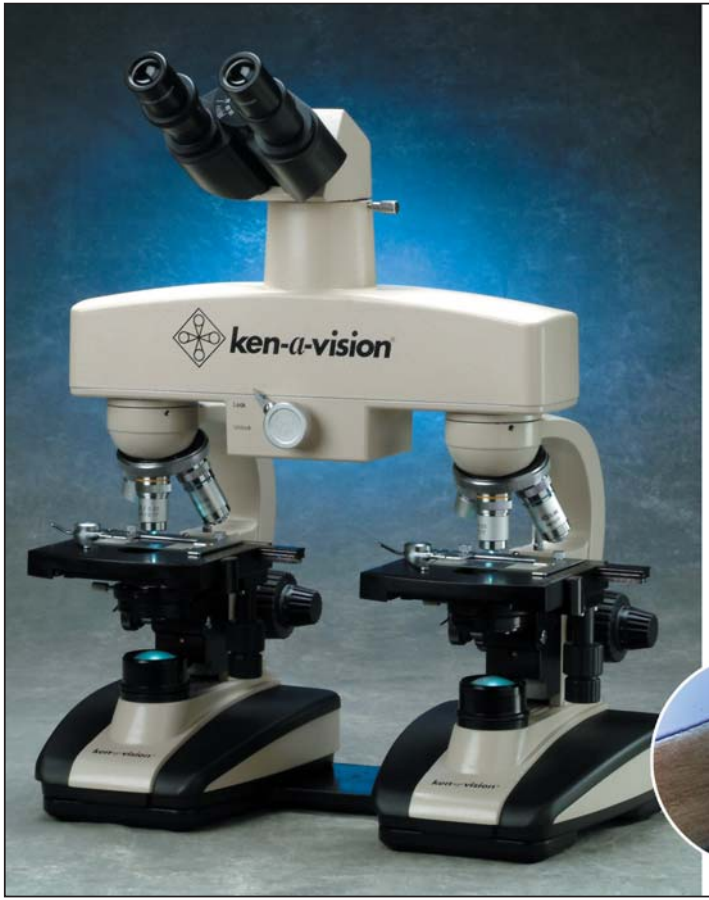

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