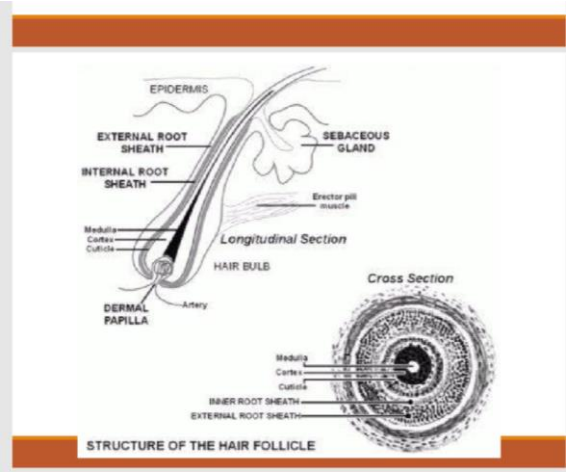
TRACE EVIDENCE 1

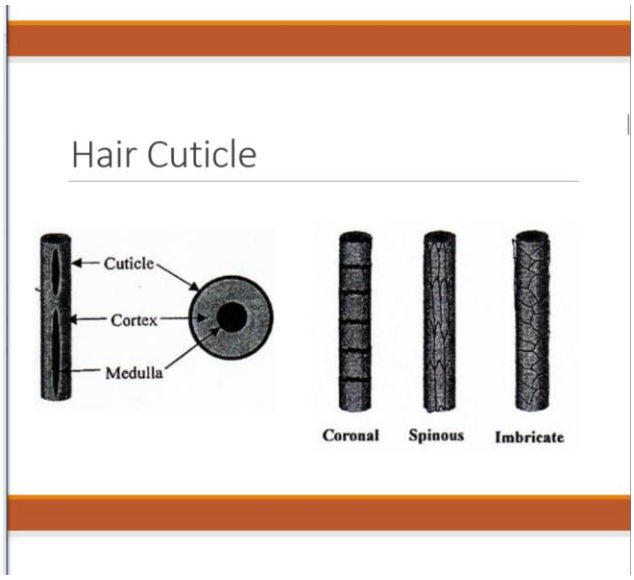
Hair :

➔Hair can't be individualize through it's morphology
➔it can still provide corroborative evidence for placing an individual at crime scene

Morphology of hair :
➔an appendage of the skin that grows our of an organ known as hair follicle
➔hair length is from follicle where it is embedded, continue to shaft till tip end
➔the shaft is the most important in the forensic science
➔shaft has 3 layers – cuticle, cortex, medulla



Cuticle:
➔ can't individualize humans but differentiating between species.
➔scale that covers the exterior of the hair.
➔scales appear flattened and point towards the tip end



Cortex :

➔major forensic importance as it is embedded with the pigment granules that impart hair with color

➔color, shape and distribution of granules provide with important points of comparison among hair of different individuals

➔color depends on the amount and type of melanin in the cortex. Less melanin means gray hair

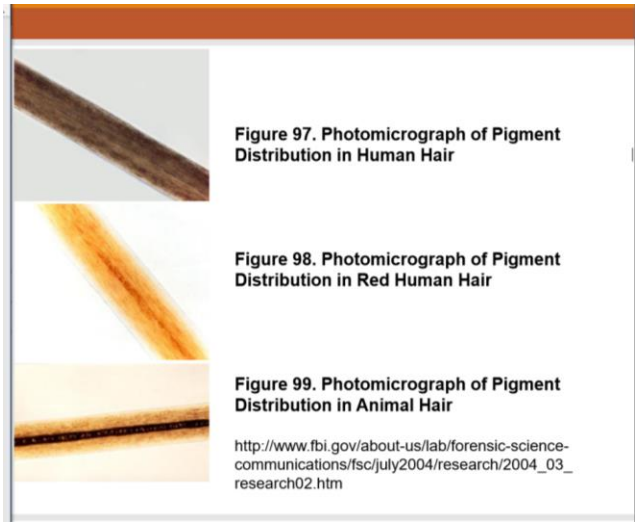


Figure 97. Photomicrograph of Pigment Distribution in Human Hair

Figure 98. Photomicrograph of Pigment Distribution in Red Human Hair

Figure 99. Photomicrograph of Pigment Distribution in Animal Hair

http://www.fbi.gov/about-us/lab/forensic-science-communications/fsc/july2004/research/2004_03_research02.htm

Medulla
➔central canal running through the hair shaft

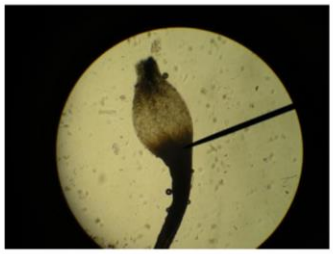
Medullary index :

➔the ratio of the medulla diameter to the diameter of the hair shaft
➔animals : the medulla occupies half of the hair's diameter. For humans : less than 1/3

Root
➔Root helps get the DNA

Stages of hair growth.
1) Anagen Phase : we get follicular tags
2) Catagen phase
3) Telogen Phase

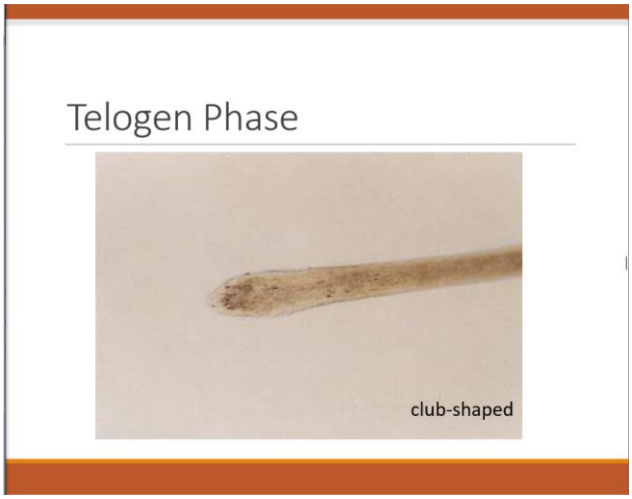
Anagen Phase



Flame Shaped

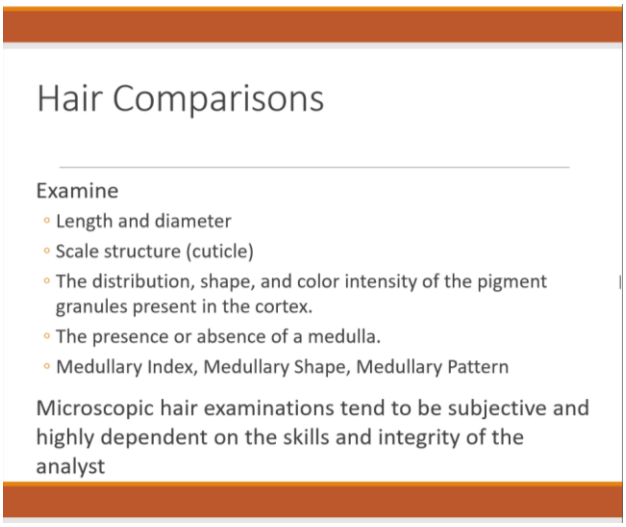
Catagen Phase

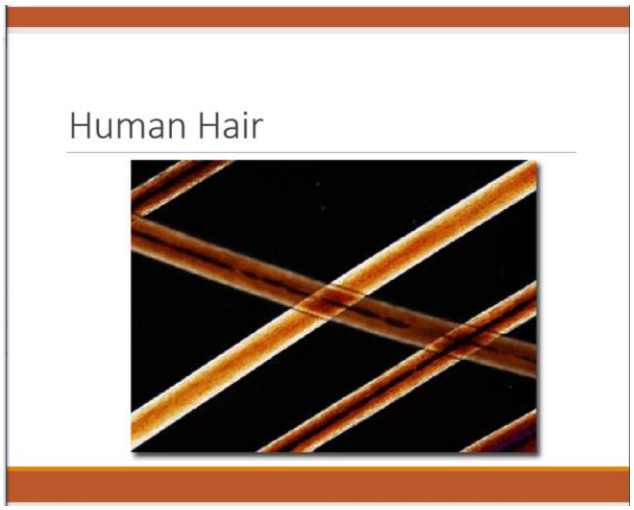
Elongated



Forcible removed hair : may or may not contain the follicular tag
Nuclear DNA : DNA from the nucleus – can be used to individualise.
➔genomic DNA

Hair comparisons : during examination – these help us compare to decide species and more info :

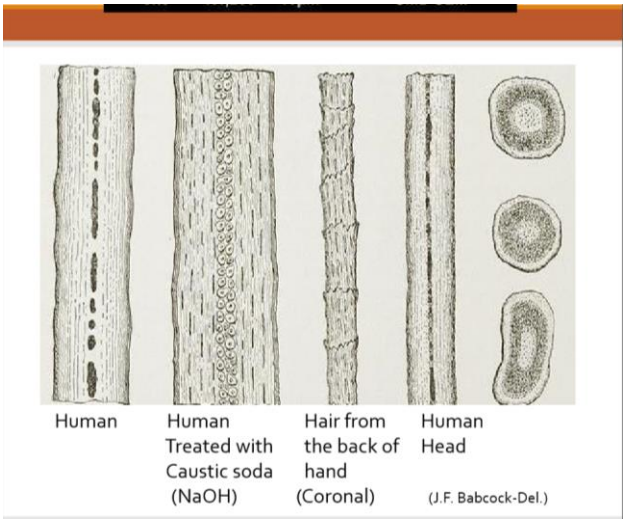


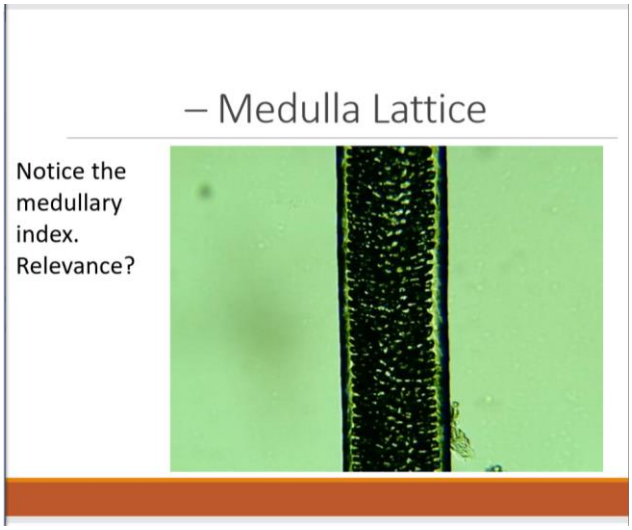


The yellow thing has absence of medulla, pyet it is all human hair only.

this is cuticle. The scales are embedded.

Hair from different parts of body look different and hence easy to identify.



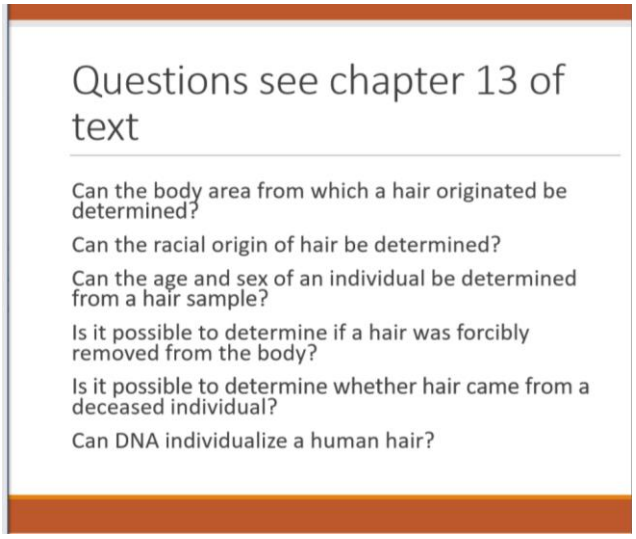


The medullar index : in here is greater than 1 half so it is an animal hair. This is a rat hair as we see in next slide.

Factors to consider :

➔ There is a difference in bleaching and dying (dye). The dye penetrates the cortex and cuticle, but naturally colored hair is only in cortex. Bleaching removes hair.

➔Bleached hair removes all the melanin from cortex and leave a yellow color.
➔We need to pay attention if hair samples have any linkage to any disease that was on the scalp like fungi or nit infections.



➔Yes, every hair is different from different part of body.
➔yes, for example, African have very curly, more than average.
➔if they were pulled out in anagen phase and they have, follicular tag , DNA

Hair and DNA
➔DNA is from anagen phase since only that has the follicular tag to get the nuclear DNA
➔Often when hair is forcibly removed a follicular tag, a translucent piece of tissue surrounding the hair's shaft near the root may be present.

Hair and Mitochondrial DNA
➔Mitochondrial DNA is sent from mum to child. It doesn't need follicular tag. Can't individualise but help.
➔Mitochondrial DNA is found in cellular material located outside of the nucleus and it is transmitted primarily from the mother to child.

Collection and Preservation of HAIR
➔Forensic hair comparisons involve either head hair or pubic hair, as per general rule
➔The collection of 50 full-length hairs from all areas of the scalp will normally ensure a representative sampling of head hair.
➔A minimum collection of two dozen full-length pubic hairs should cover the range of characteristics present in pubic hair
➔Hair samples are also collected from the victim of suspicious deaths during an autopsy

The microscopic hair comparisons must be regarded by police and the courts as presumptive
Positive comparisons must be verified with DNA analysis

Limitations

M. M. Houk and B. Budowle, 'Correlation of Microscopic and Mitochondrial DNA Hair Comparisons,' Journal of Forensic Sciences; 47 (2002): 964

◦ Determined the Mitochondrial DNA profile for hair samples that FBI hair examiners had positively identified as a match via morphological observation (microscopically)

◦ 11% of the 'positive matches' did not share the same Mitochondrial DNA profile

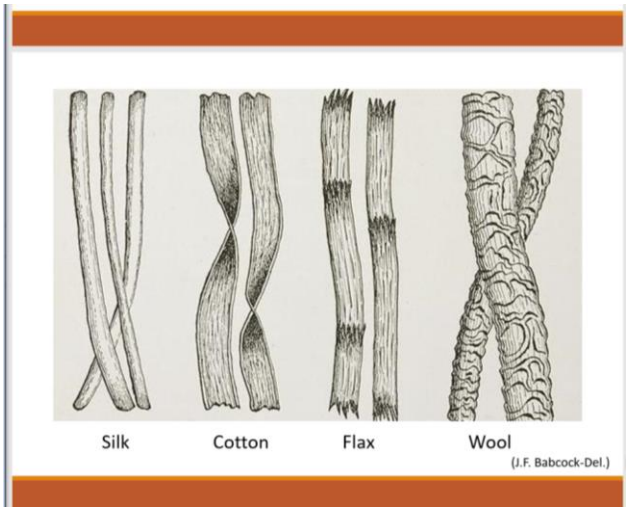
---

Fibres

➔Polymers, macromolecules composed of large number of atoms arranged in repeating units known as monomers.

Natural Fibres :

1) Animal Origin : wool, mohair, cashmere (goat), furs
2) Plant Origin : cotton, hemp, flax



Chemically manufactured : Plastics, Paints, Adhesives, Rubber
In nature : Animal hair structure is a polymer composed of thousand of amino acids
: Cellulose is a polymer(polysaccharide) composed of thousands of carbohydrates(sugars)

Regenerated fibres are man made fibres made from natural raw materials

Synthetic fibres are produced solely from synthetic chemicals.

Fibre Evidence :

➔The quality of evidence depends on the ability of criminalist to identify the origin of the fiber or at least be able to narrow the possibilities of a limited number of sources

➔if the examiner is presented with fabrics that can be exactly fitted together at their torn edges

Fiber comparisons
➔Like hairs, the use of a comparison microscope is essential for examining color, diameter, lengthwise striations, the presence of delustering particles and other additives in the manufacturing process.

Chemical composition
➔If the morphological characteristics match, chemical analyses are required to conclude the possibility of two fibres having the same origin.

Spectral Profile : spectrophotometer gives a spectral profile of the hair when looked through it.

Microscopy and spectrophotometry to profile fibres and other trace evidence
➔visible light source
➔infrared light source
➔ultra-violet light source
➔each gives a spectrum of the sample and reference for comparison

Obtain spectral profile (s)
◦ Can differentiate similar colours

◦ Synthetic polymers absorb infrared light in a characteristic pattern that can be specific to that type of textile

Collection and preservation of fibres.
➔The investigator's task of looking for minute strands of fibres often becomes one of identifying and preserving potential "carriers" of fiber evidence.
➔Relevant articles of clothing should be packaged carefully in separate paper bags.
➔If it is necessary to remove a fiber from an object, the investigator must use clean forceps, place it in a small sheet of paper, fold and label the paper, and place the paper packet inside another container.