Hair Analysis

Information from hair evidence

- Hair is considered class evidence…can't be used to identify a specific individual, but can be used to identify a group or class of people who share similar traits
- offers clues to the broad racial background of an individual
- Chemical tests provide a history of drug use and other toxins
- If the follicle is present, DNA evidence may be obtained

Function of Hair

- Main purpose is for body temperature regulation
- Also used to decrease friction, to protect against sunlight and to act as a sense organ

Structure of Hair

- Follicle – club-shaped structure that goes in the skin
  - The actively growing root or base of a hair containing DNA and living cells
- Shaft – composed of keratin, a protein
  - Made up of three layers; the inner medulla, a cortex and an outer cuticle
  - Has cuticle scales that are flattened and narrow, also called imbricate

The Cuticle

- The transparent outer layer of the hair shaft
- Made up of scales that overlap one another and protect the inner layers of the hair
- Scales point from the top of the hair down to the bottom

Types of Cortex

- The cortex is the largest part of the hair shaft
- The part of the hair that contains most of the pigment granules (melanin) that give hair its color

Types of Medulla

- The center of the hair
- Can be a hollow tube or filled with cells
- In some people, it is absent, in others, it is fragmented or segmented, and in others, it is continuous or even doubled

Five Different Medulla Patterns

- 1. Continuous – one unbroken line of color
- 2. Interrupted – pigmented line broken at regular intervals
- 3. Fragmented or segmented – pigmented line unevenly spaced
- 4. Solid – pigmented area filling both the medulla and the cortex
- 5. None – no separate pigmentation in the medulla

Types of Hair

- Hair can vary in length, shape, diameter, texture and color
- The cross section may be circular, triangular, irregular, or flattened, influencing the curl of the hair
- The texture can be coarse or fine
- Hair color varies depending on distribution of pigment granules and on hair dyes that may have been used.
- Hair varies on an individual person
- Usually 50 hairs are collected from a suspects head; 25 from the pubic region

Hair from different body parts

- Forensic scientists distinguish six different types of hair on a human body. They are distinguished by their cross-sectional shape
- 1. head hair – circular or elliptical
- 2. eyebrows and eyelashes – circular with tapering ends
- 3. beard and mustache hair – thick, triangular
- 4. underarm hair – oval or triangular
- 5. auxillary or body hair – oval or triangular
- 6. pubic hair – oval or triangular

Life Cycle of Hair

- 1. Anagen Stage – period of active growth
  - Cells around the follicle are rapidly dividing and depositing materials within the hair
  - 80-90% of hair is in this stage
  - Lasts approximately 1000 days
- 2. Catagen Stage – hair grows and changes
  - May turn grey
  - 2% of hair growth and development
- 3. Telogen Stage – hair follicle is dormant and hairs are easily lost
  - 10-18% of hairs are in this stage

Treated Hair

- Bleaching – removes pigment granules, makes hair brittle and disturbs scales on the cuticle
- Hair grows at a rate of 1.3 cm per month
- Can figure out when hair was last dyed by measuring the part of the hair that is naturally colored (the root) and dividing by 1.3

Racial Differences

Race	Appearance	Pigment Granules
African	Kinky, curly or coiled	Densely distributed, clumped, may differ in size and shape
Asian	Straight	Densely distributed
Caucasian	Generally straight or wavy	Small, evenly distributed

Animal Hair and Human Hair

	Animal Hair	Human Hair
Pigmentation	Denser in the medulla Change color abruptly (banded)	Denser toward the cuticle Usually one color along the length
Medulla	Larger than in humans (medullary index of 0.5 or greater)	Medullary index of 0.33 or less
Cuticle	Rodents, bats – coronal cuticle Cats, seals – spinous cuticle	Imbricate cuticle – flattened and narrow

Hair Analysis & Substances in the Shaft

- Microscopy – looks for patterns of the medulla, pigmentation of the cortex and scales on the cuticle
- Ingested or absorbed toxins, like arsenic, lead and drugs, can be detected by chemical analysis of hair
- Can develop a timeline of exposure based on hair growth rate (1.3 cm /month)