

## Introduction to Forensics and Hair Lecture:

### Part 1: What types of information can be gained from analysis of hair?

Physical characteristics: Can offer broad racial background

Does not decompose readily

Chemical testing: history of drug use, other toxins, heavy metals and nutrient deficiencies

What are the limitations that information?

#### Types of Evidence:

Class evidence (without bulb): material that connects an individual or thing to a certain group

Individual evidence (with hair bulb): a kind of evidence that identifies a particular person or thing

Trace evidence: small but measurable amounts of physical or biological material found at a crime scene.

Locard's exchange principal: whenever two objects are in contact, some transfer of material will occur

Hair is a major source of trace evidence:

Using hair as evidence started as early as the mid 1800s by the early 1900s comparison microscopy allowed side by side analysis.

Modern Hair analysis includes:

1. Physical traits
2. chemical: degrade keratin
3. neutron activation: gamma radiation signals are unique in combination of 9 (1 in a million)
4. DNA Fingerprinting

Functions of hair:

1. Regulate body temp: associated with muscles in the skin
  - a. When you are cold, muscles hold hair upright pulling on the skin and make pockets of trapped air = insulation
2. decrease friction
3. protect against UV light
4. act as a sense organ

### Part 2: Structure of Hair:

<http://dermatology.about.com/cs/hairanatomy/a/hairbiology.htm#>

Hair Shaft has 3 parts: grows from a collection of cells = follicle (vascular)

Pencil analogy

1. Cuticle: [http://www.fbi.gov/hq/lab/fsc/backissu/jan2004/research/2004\\_01\\_research01b.htm](http://www.fbi.gov/hq/lab/fsc/backissu/jan2004/research/2004_01_research01b.htm)
2.
  - a. Transparent outer layer
  - b. look for patterns to id source organism
    - i. imbricate: human cuticle is narrow, flattened scales
      1. scales point from distal end to proximal end

2. imp if looking for drug history or dyeing history
    - a. hair grows 1.3 cm/ month or .44 mm/day
    - b. Divide natural hair color by 1.3 to see time since last dyed or poisoned
  - ii. coronal: rodents, bats looks like stacked crowns
  - iii. spinous: cats, seals, mink looks like petals
3. Cortex
- a. Largest part of the hair and contains pigment granules = melanin
4. Medulla
- a. Pigmented (filled with cells) or unpigmented (hollow tube)
  - b. Can have a pattern see below
  - c. Index: allows to id as animal or human hair

### Part 3: Characteristics of hair:

1. texture: ratio of cuticle to medulla
  - a. average for coarse: 10% and fine: 20-40%
2. Medullary Index: allows one to distinguish between animal and human hair

$$\text{Medullary Index} = \frac{\text{diameter of hair's medulla}}{\text{diameter of the hair}}$$

M.I. = <.33 hair is human

M.I. =>.5 or more, hair is animal

3. Human Medullary Patterns has 5 types:
  - a. Continuous medullary canal
  - b. Interrupted medulla : (regular interruption)
  - c. Fragmented medulla : (interruption irregular)
  - d. Absent
  - e. Doubled
4. Types of Hair: varies in shape, length, pattern, diameter, texture, color, location
  - a. Due to inconsistencies in hair need at least 50 for a region and 25 from pubic region
  - b. One way to distinguish type of hair is to look at cross section
    - i. Head: circular or elliptical cross section
    - ii. Eyebrows and eyelashes: elliptical with tapering ends
    - iii. Beard, mustache: thick, triangular, may be double medulla , coarse
    - iv. Underarm: oval or triangular
    - v. Body hair: blunt tip, may be frayed: oval or triangular
    - vi. Pubic: diameter varies greatly, may have buckling, oval or triangular

### Life Cycle of Hair: 3 stages

1. anagen stage: 1000 days, 80-90% of hair, actively dividing cells at follicle and deposition of materials
2. catagen stage: grows and changes (perhaps turning gray) 2%
3. Telogen: follicle os dormant or resting and hair easily lost

	Animal Hair	Human Hair
Pigmentation	Denser towards medulla	Tends to be denser towards cuticle
Color	Can change color abruptly : banded patterns	Usually one color along the length
Medullary index	Over .5	Under .33
Cuticle	Coronal or spinous	imbricate