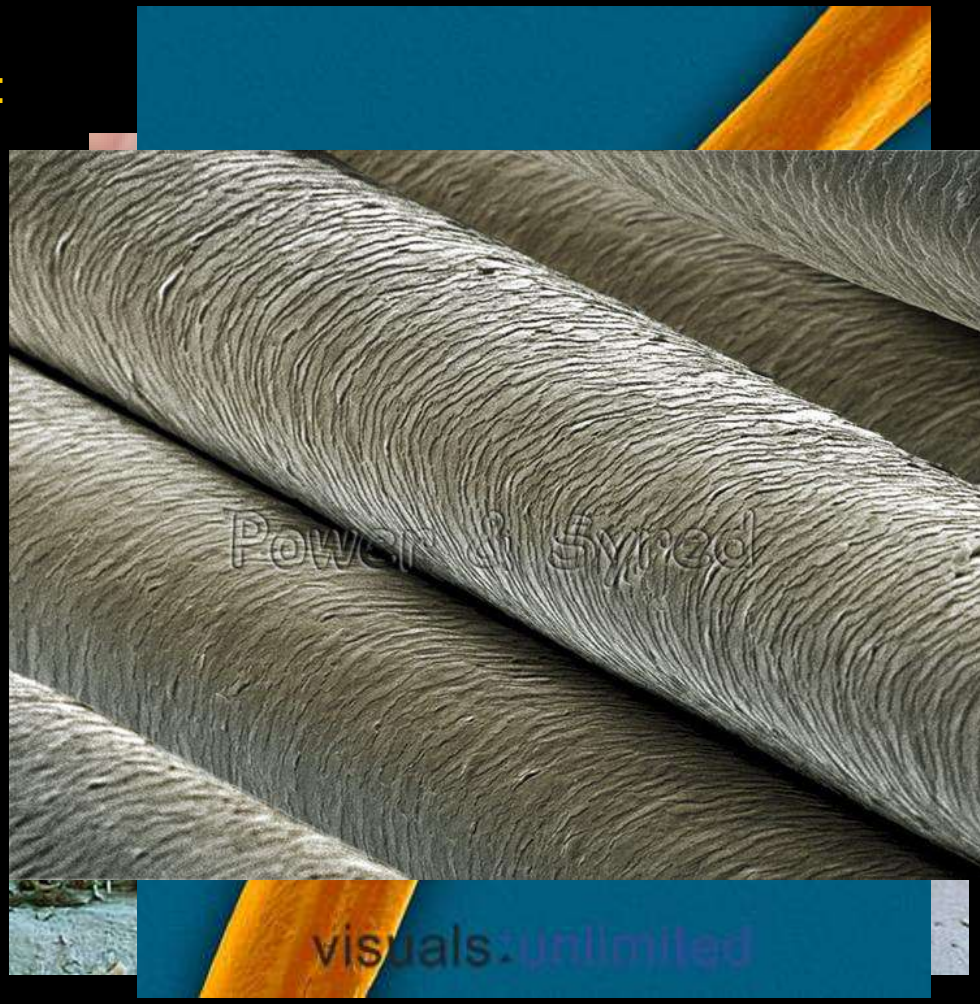
Warmup:  Read the case study on pg 336, then answer the following questions.

1. What happened to the “Central Park Jogger”?
2. What evidence caused the boys to be convicted?
3. What eventually happened to the boys and what caused that decision to be made?

# 2.4: Examination of

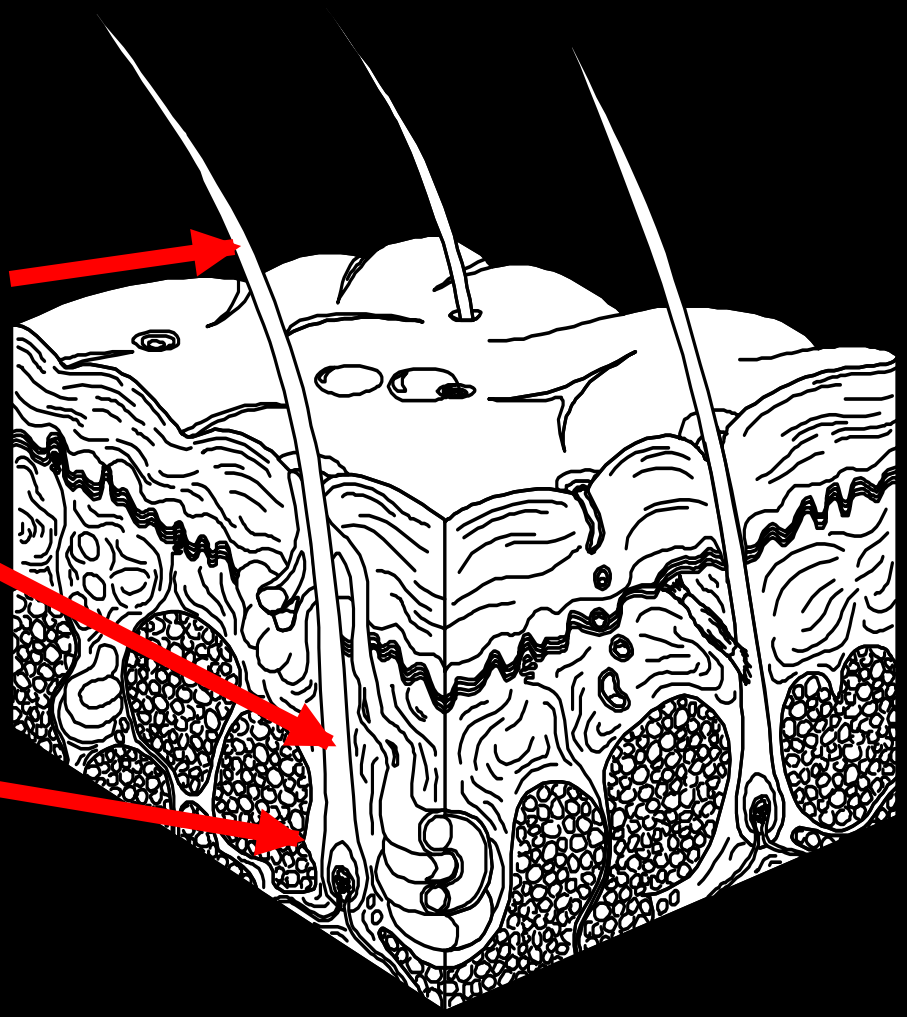
# Microscopic Evidence and Its Analysis

- HAIRS
  - Most frequently found evidence at the scene of a violent crime
  - Can provide link between criminal, victim, and crime scene
  - From hair, one can determine:
    1. Human or Animal
    2. Race
    3. Origin
    4. Manner of removal
    5. Treated hair
    6. Drugs ingested



# Microscopic Evidence and Its Analysis

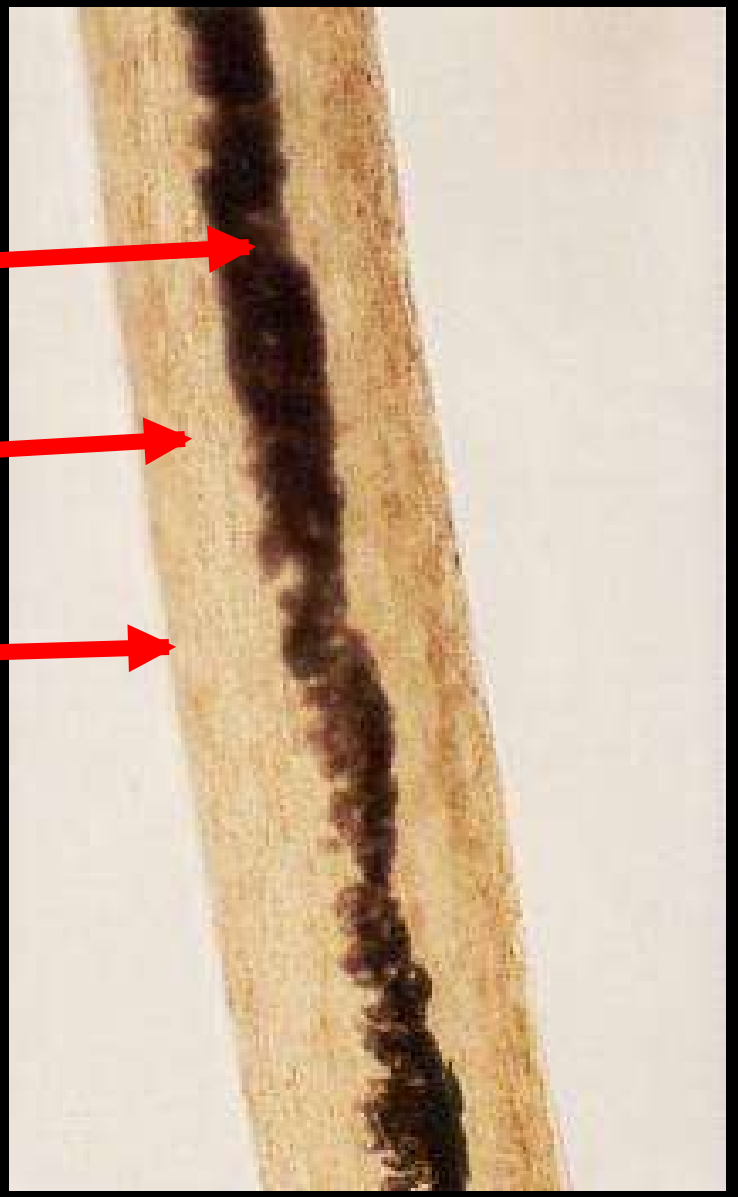
- HAIRS
  - Hair Morphology
    - Shaft: sticks out of the skin
    - Root: below epidermis
    - Follicle: structure from which it grows



# Microscopic Evidence and Its Analysis

- HAIRS
  - Hair Morphology

- Medulla
- Cortex
- Cuticle

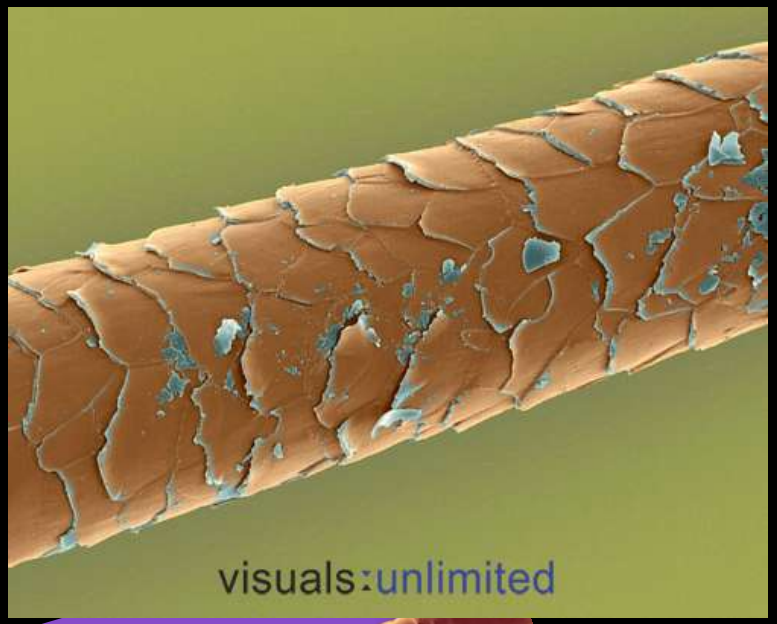


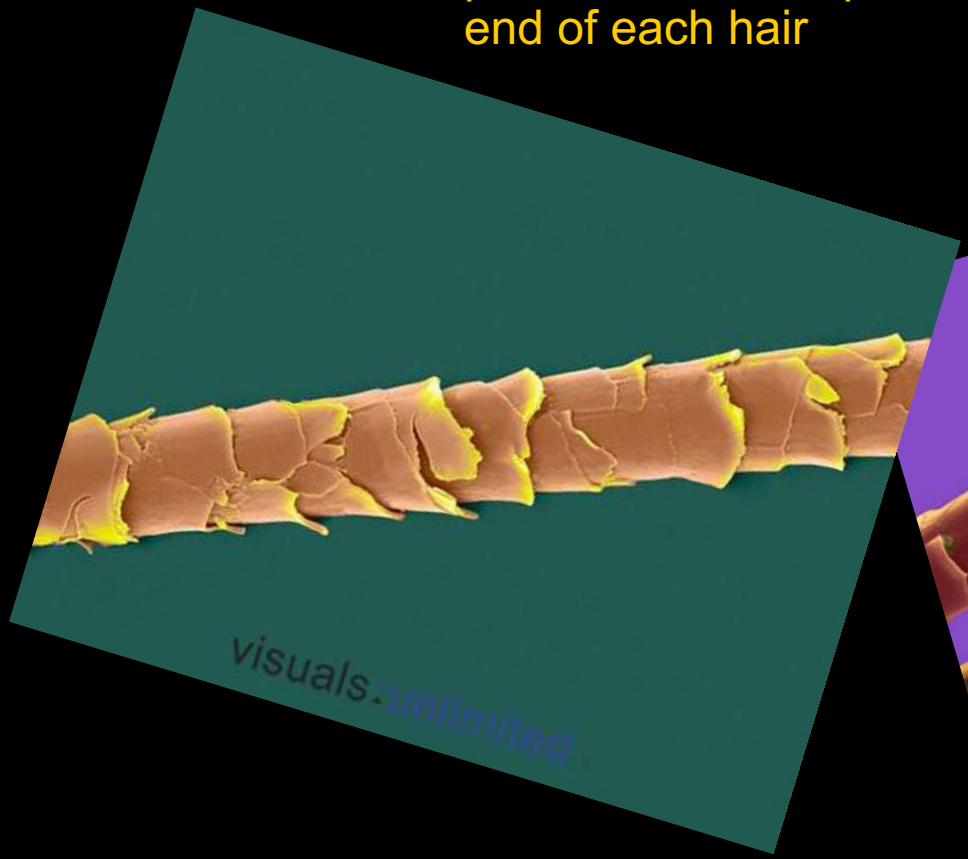
Two features that make hair a good subject for identification:

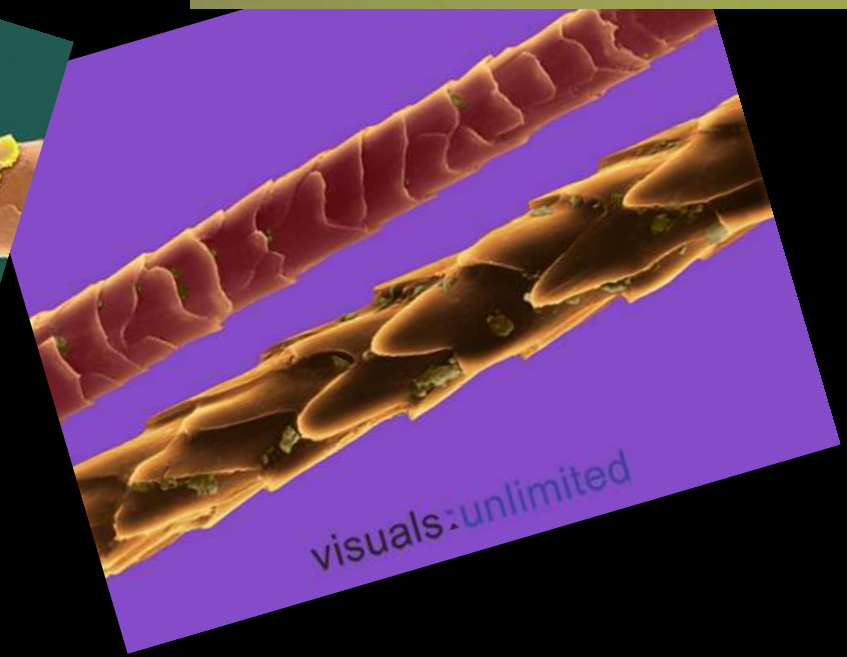
1. Resistance to chemical decomposition
2. Ability to retain features for a long time

# Microscopic Evidence and Its Analysis

- HAIRS
  - Hair Morphology
    - CUTICLE
      - Formed by overlapping scales that always point toward the tip end of each hair



# Microscopic Evidence and Its Analysis

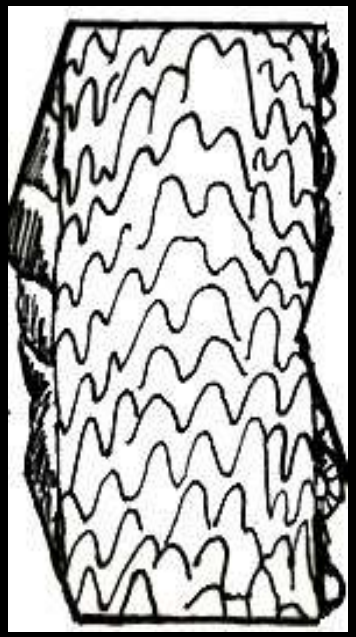
- HAIRS
  - Hair Morphology
    - CUTICLE
      - Scale variations dependent on species

Mosaic

Pectinate

Imbricate

Petal



Diamond Petal

Chevron

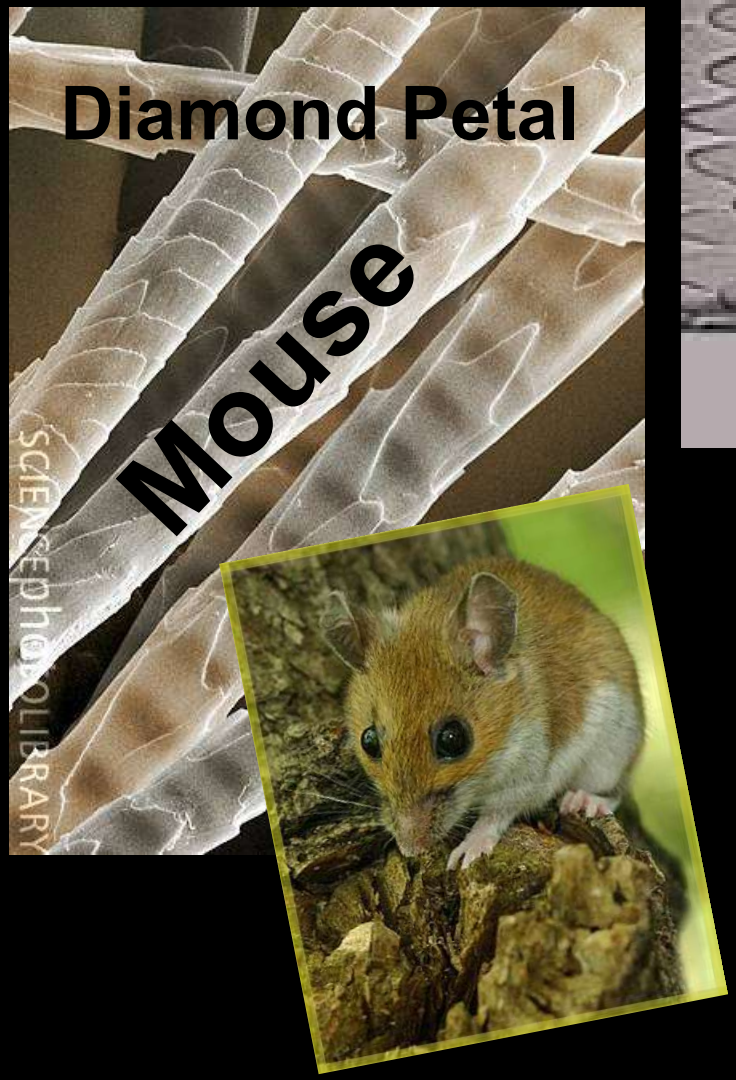
# Microscopic Evidence and Its Analysis

- HAIRS
  - Hair Morphology

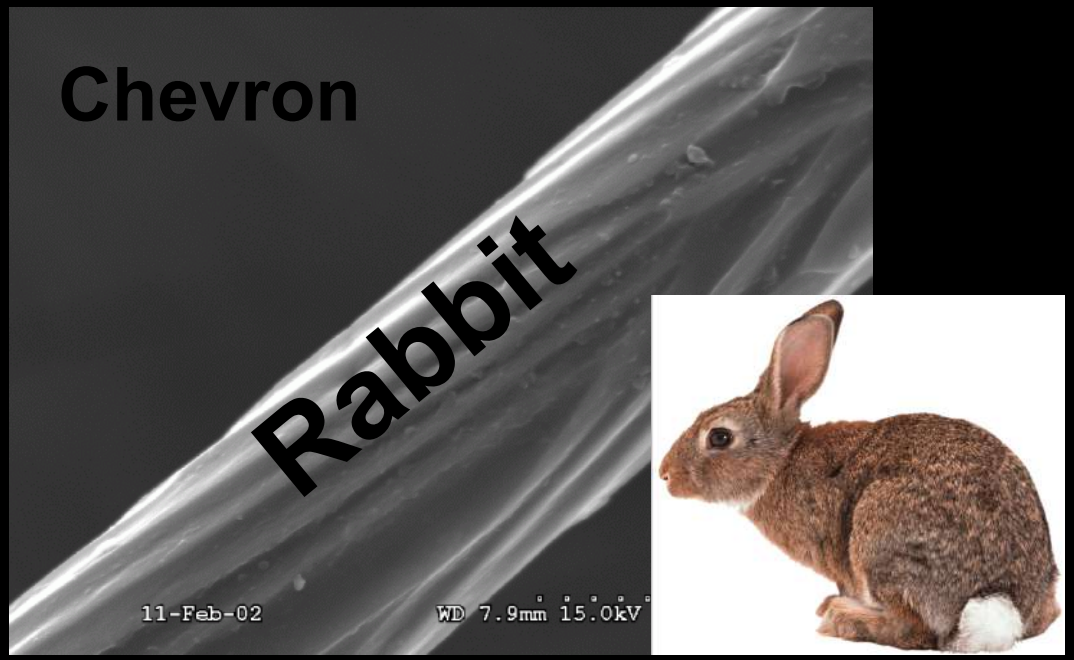


# Microscopic Evidence and Its Analysis

- HAIRS
  - Hair Morphology







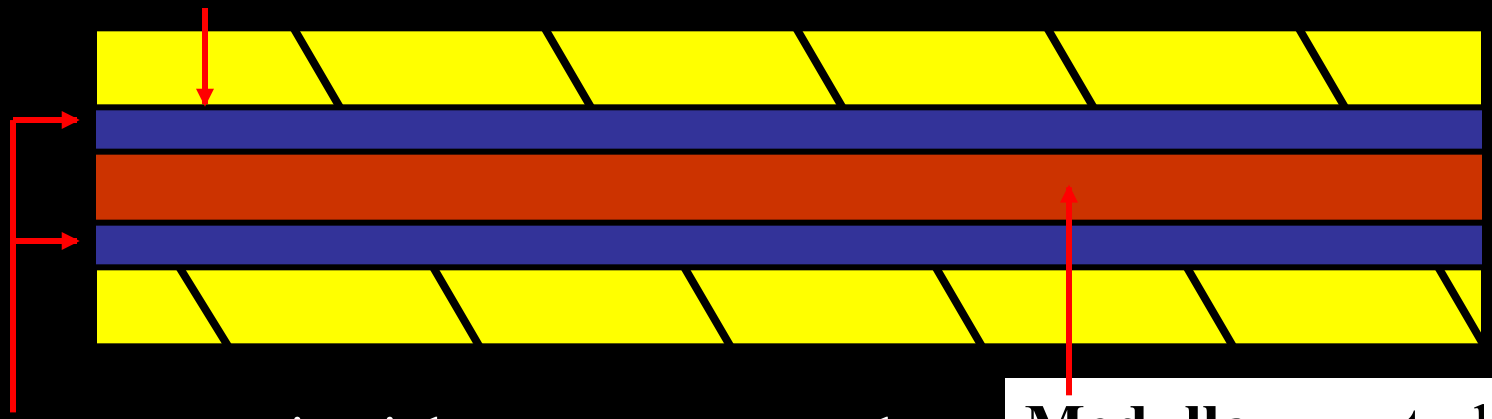
# Cuticle Visualization

1. Scanning electron microscope

2. Make a cast of its surface using clear nail polish or softened vinyl

# Hair Structure

**Cuticle** – outer coating composed of overlapping scales



**Cortex** – protein-rich structure around the medulla that contains pigment

**Medulla** – central core (may be absent)

The structure of hair has been compared to that of a **pencil** with the medulla being the **lead**, the cortex being the **wood** and the cuticle being the **paint** on the outside.

# Microscopic Evidence and Its Analysis

- middle layer, made of spindle-shaped cells (keratin) aligned in a regular array, parallel to the length of the hair, consisting of:

- CORTEX

  - **melanin**: pigment granules that give hair its color

- Points of forensic comparison – color, size, shape, distribution

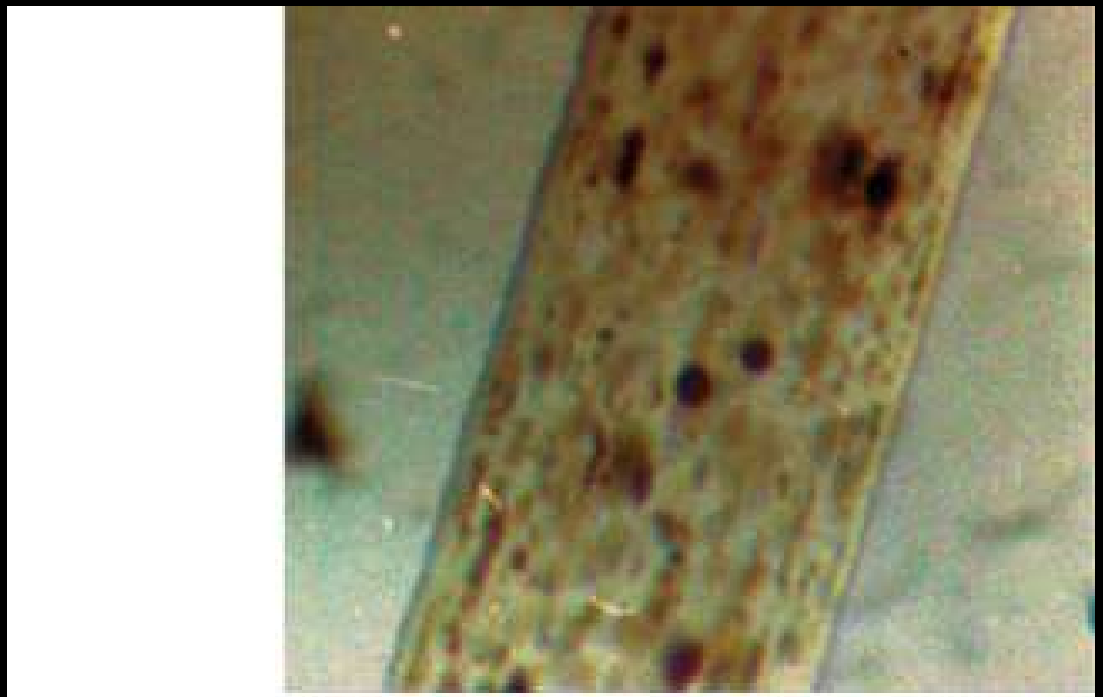


**Figure 3** - CHS: hair under light microscopy (x100).

# MEDULLARY INDEX

measure the diameter of the medulla relative to the diameter of the hair shaft:

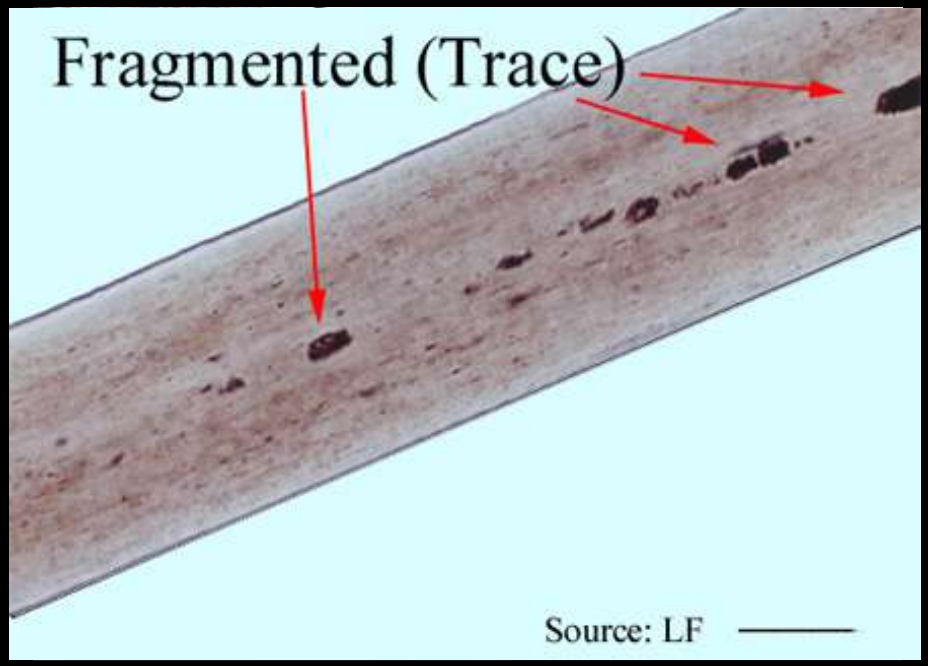
humans= <1/3

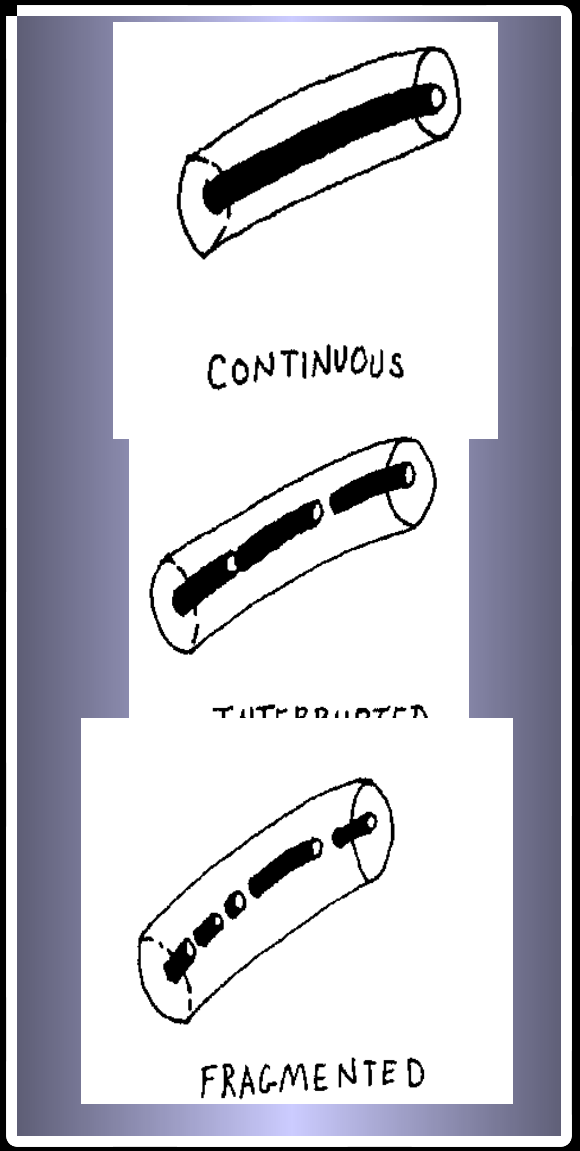
other animals= 1/2 or >

# Microscopic Evidence and Its Analysis

- canal-like, innermost layer of cells, variety of types and patterns

- MEDULLA - 4 Types
  1. Continuous: most animals, seldom humans
  2. Interrupted (Discontinuous): human pubic hair, sometimes head hair
  3. Fragmented: mostly human hair
  4. Absent: human hair

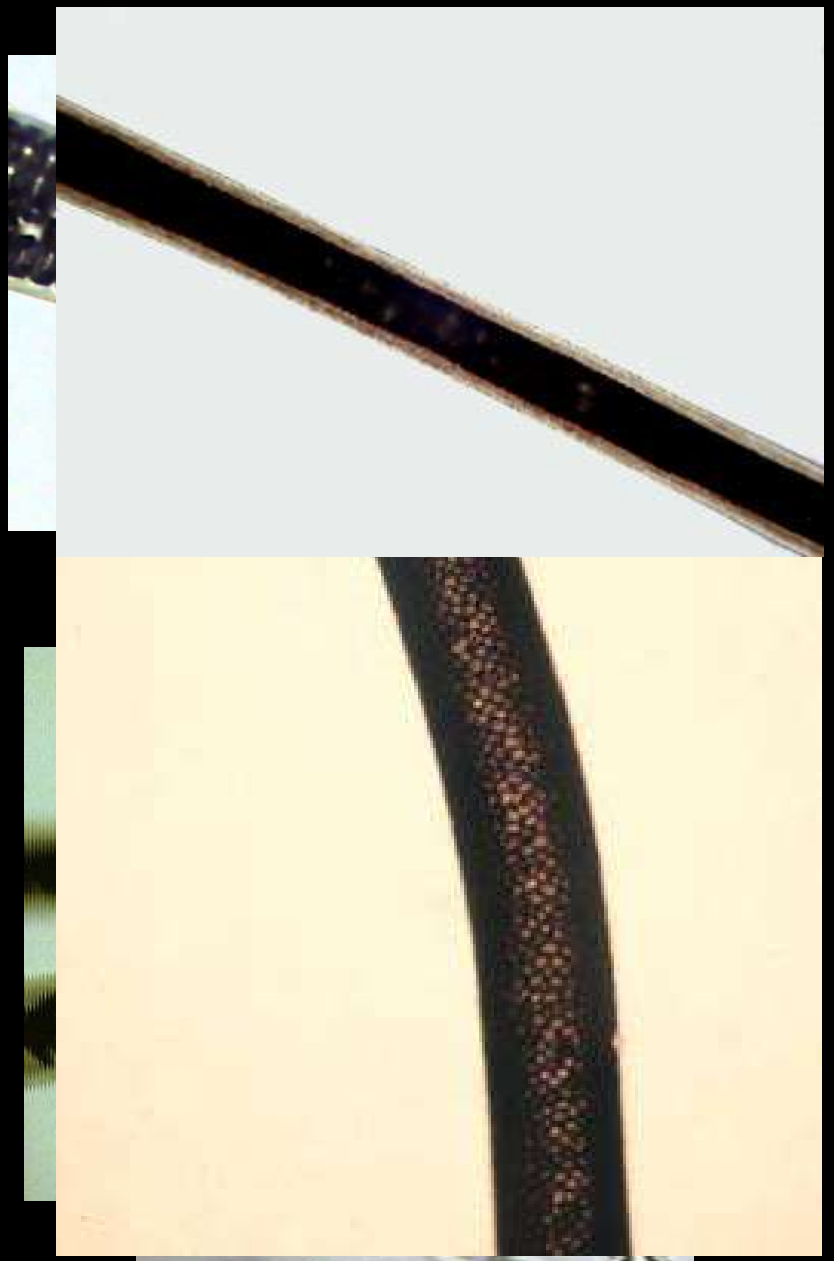


# Microscopic Evidence and Its Analysis

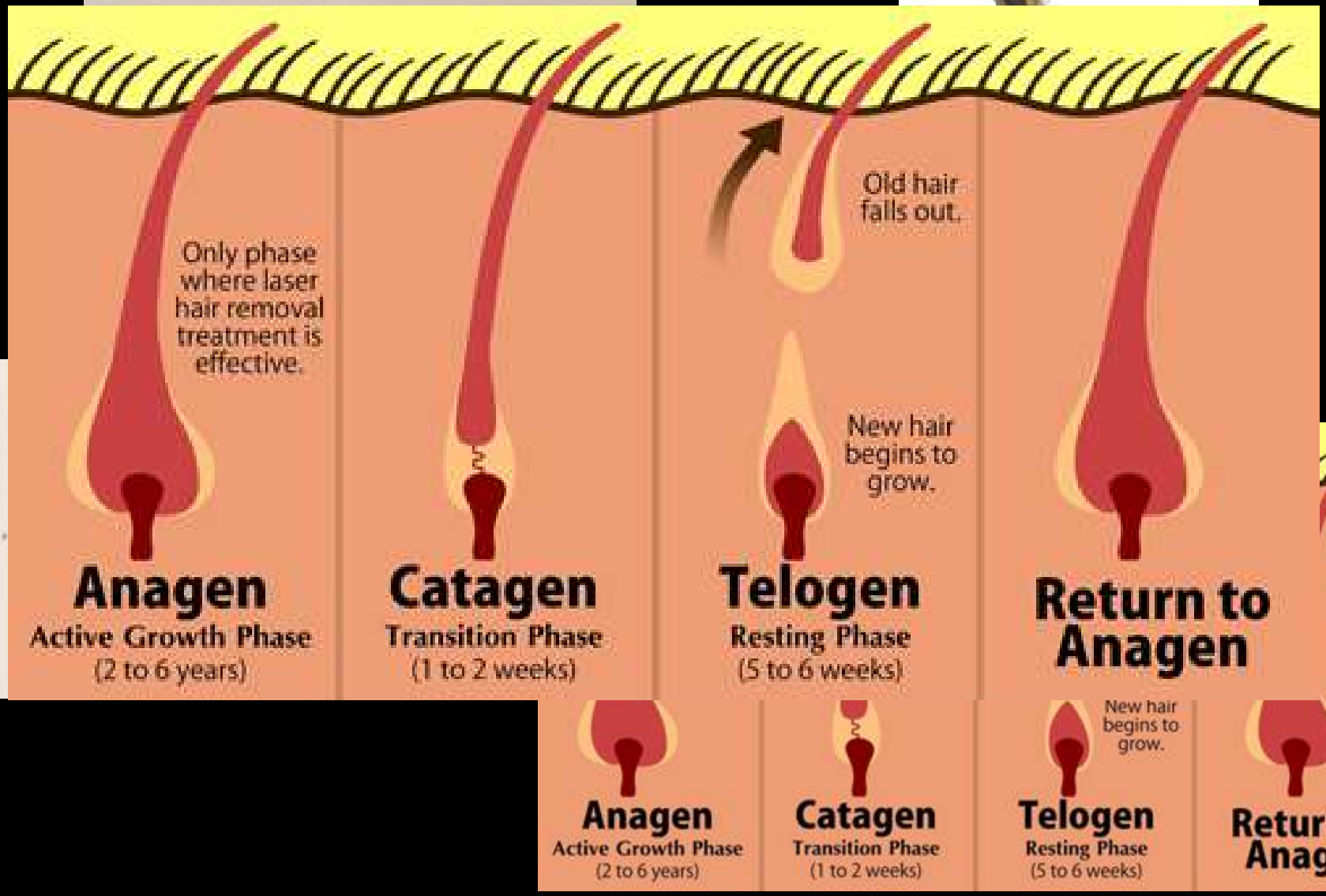
- HAIRS
  - Hair Morphology
    - MEDULLA - 5 Patterns

1. Amorphous: no specific pattern
2. Uniserial: small blocks in a row
3. Multiserial: several rows of blocks across
4. Vacuolated: uneven pattern
5. Lattice: circular patterns

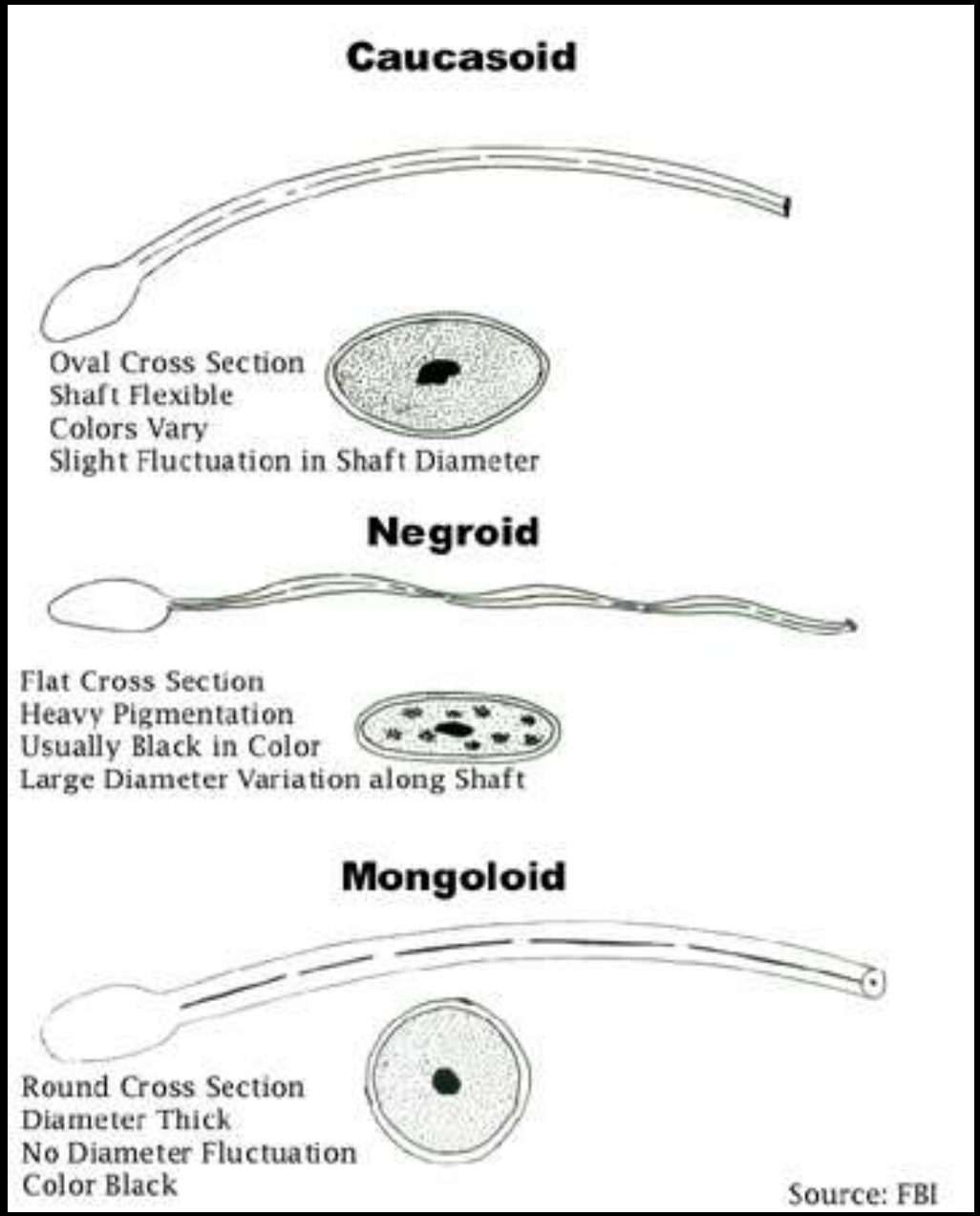


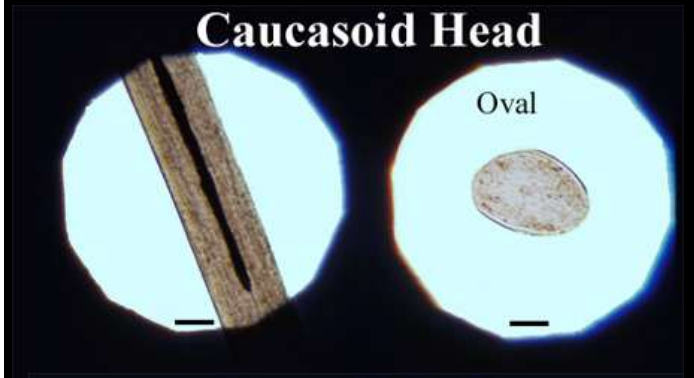
# THREE GROWTH PHASES OF THE ROOT:

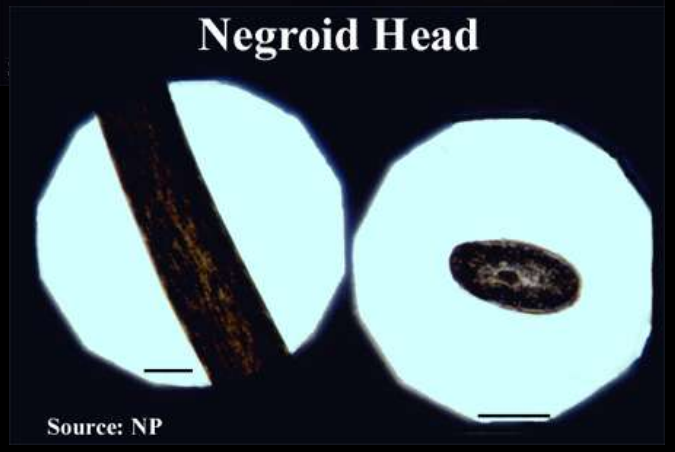
1. Anagen = initial growth (follicular tag-rich source of DNA)-flame shaped
2. Catagen = transition stage (elongated)
3. Telogen = final growth (club-shaped)


Only phase where laser hair removal treatment is effective.
Old hair falls out.
New hair begins to grow.
Anagen
Active Growth Phase
(2 to 6 years)
Catagen
Transition Phase
(1 to 2 weeks)
Telogen
Resting Phase
(5 to 6 weeks)
Return to Anagen
Anagen
Active Growth Phase
(2 to 6 years)
Catagen
Transition Phase
(1 to 2 weeks)
New hair begins to grow.
Telogen
Resting Phase
(5 to 6 weeks)
Return to Anagen

# Microscopic Evidence and Its Analysis




3 FEATURES IMPORTANT FOR HAIR ID:

1. Scale structure
2. Medullary index
3. Medullary shape

## 7 hair characteristics that interest Criminalists:

1. Matching color
2. Length
3. Diameter
4. Presence or absence of medulla
5. Distribution
6. Shape
7. Color intensity of pigment granules

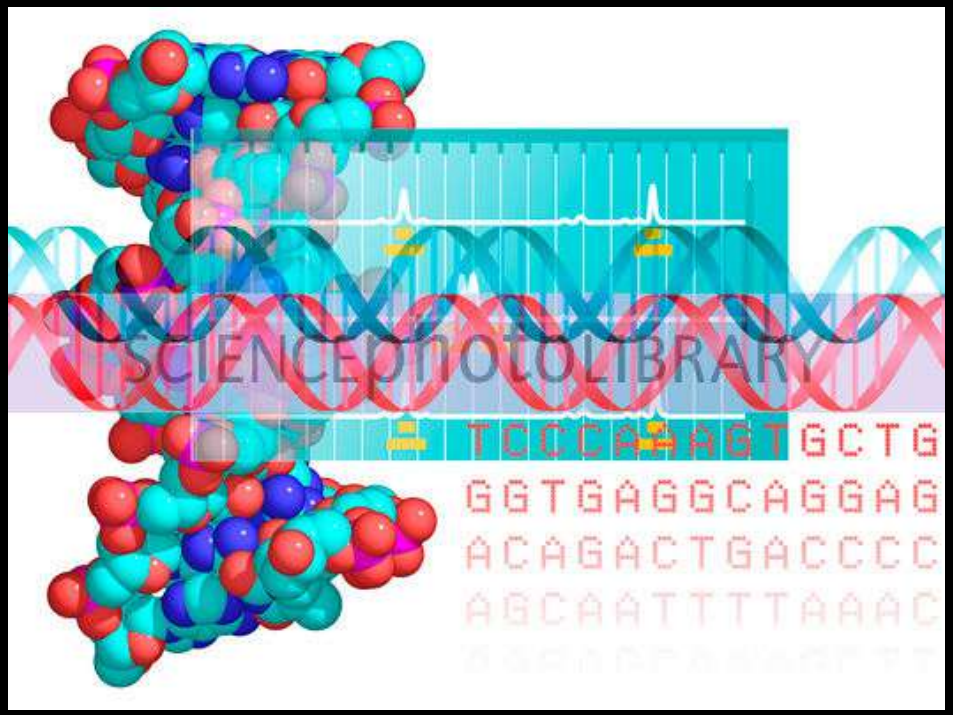
How fast does hair grow on average?

1cm per month

Infections

Chemicals

DNA ANALYSIS



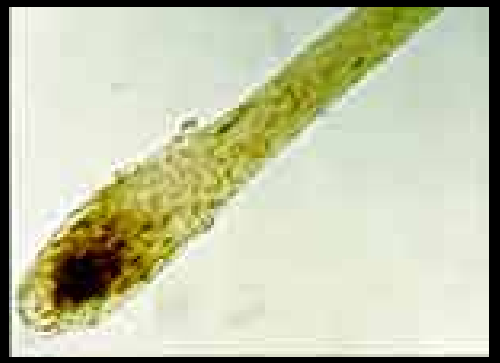

COMPARISON MICROSCOPE

# Microscopic Evidence and Its Analysis

- Root Characteristics: Removal

Pulled

Forcibly removed



Shed

- Tip Characteristics

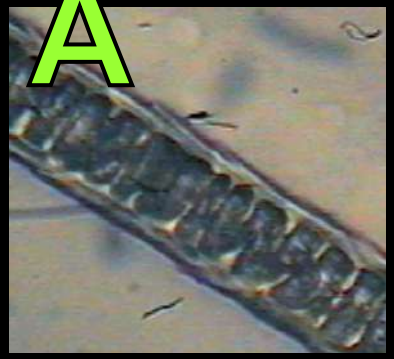
Burned

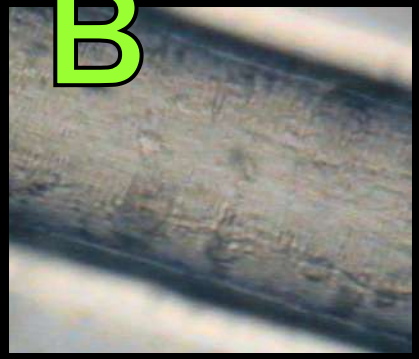
Cut

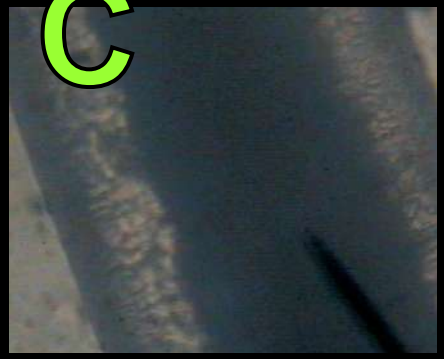
Razored

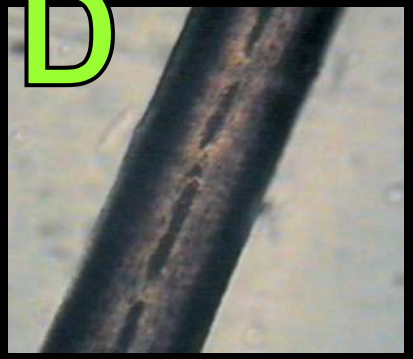
Split

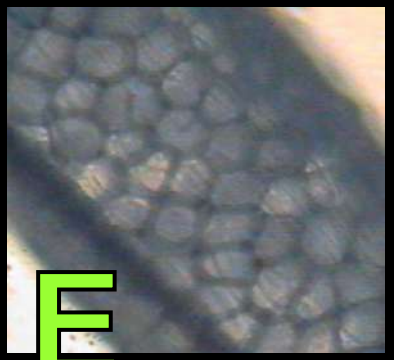
# Can you identify the animal hairs shown?

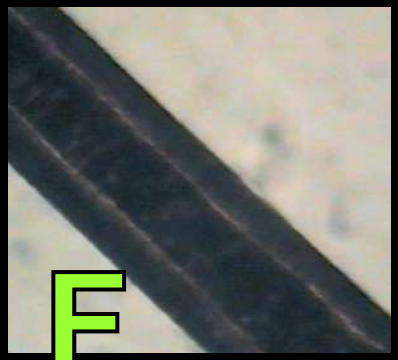


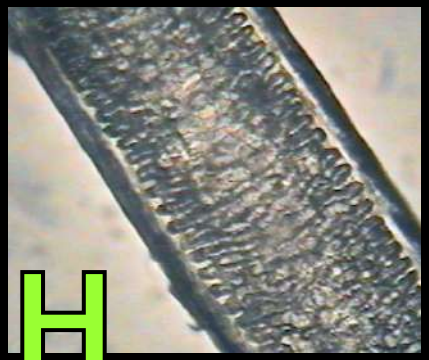



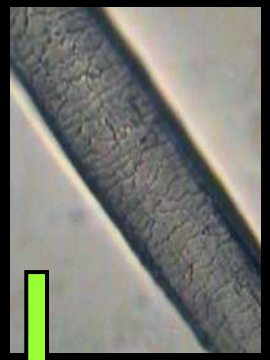








**Think About It …**

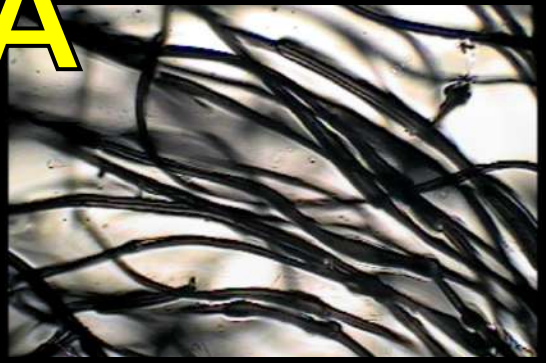
(1) In which samples are we viewing the cuticle? How do they compare?

(2) In which samples are we viewing the medulla? How do they compare?

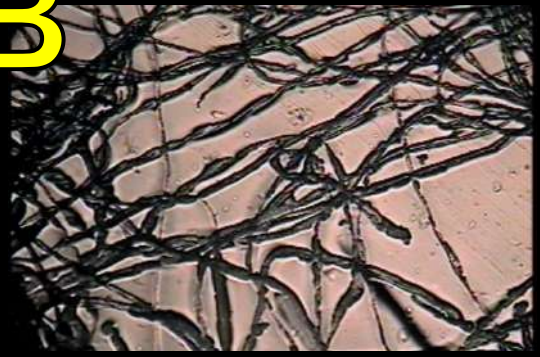
(3) What characteristics can be used to identify hair samples?

# Can you identify the types of fibers shown?

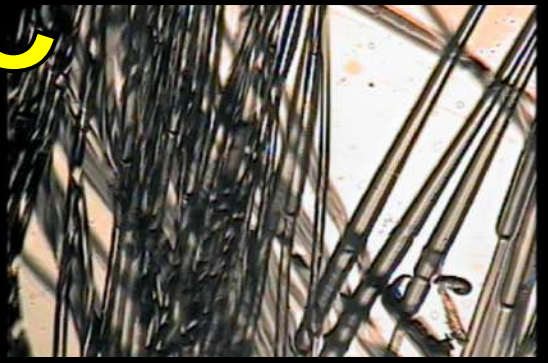
A

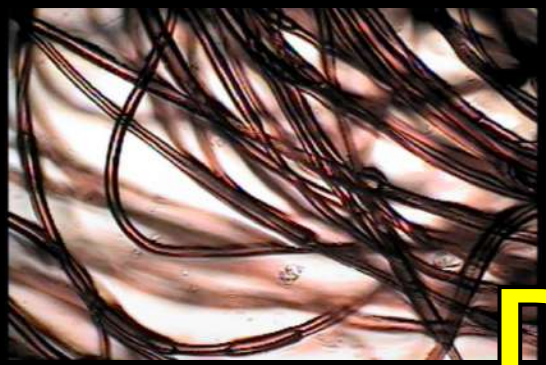


B



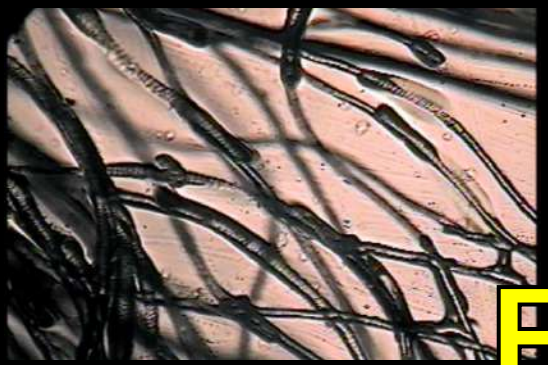
C





D

E



F

**Think About It …**

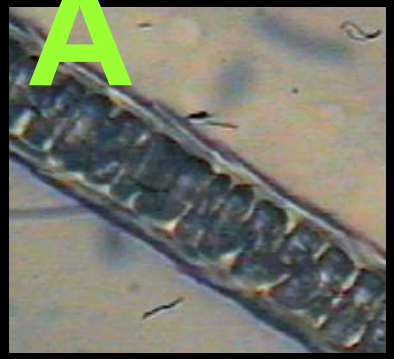
(1) Which samples are natural fibers?

(2) Which samples are synthetic fibers?

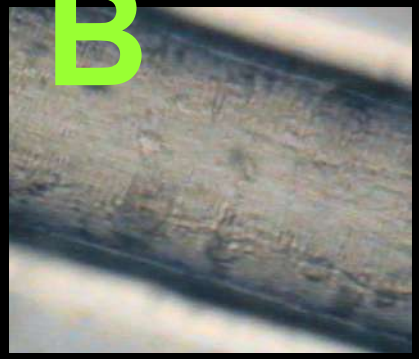
(3) What characteristics can be used to identify fiber samples?

# Answer Keys

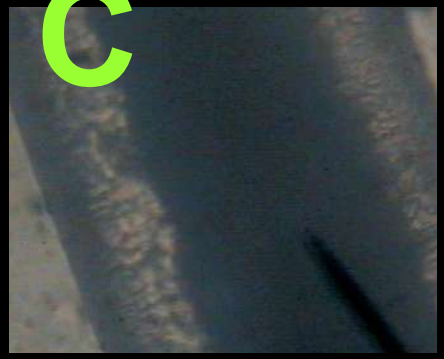
# Types of Animal Hairs - Key



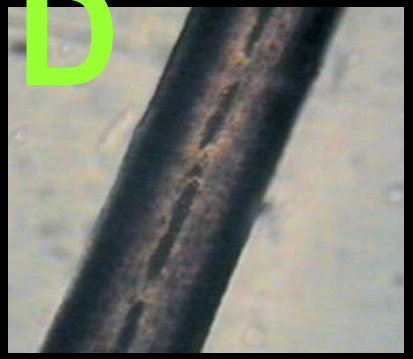

Cat



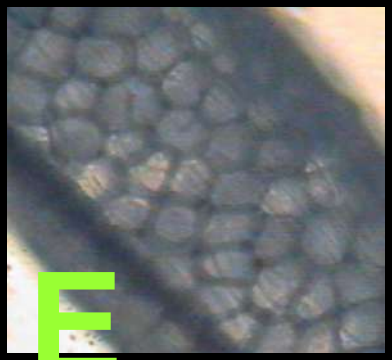

Horse



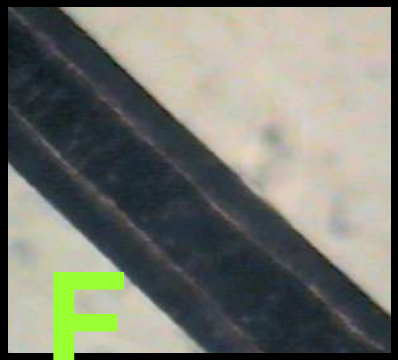

Pig




Human

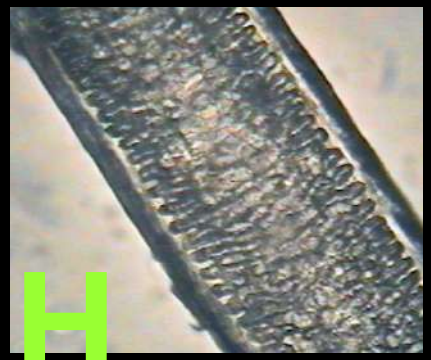



Deer

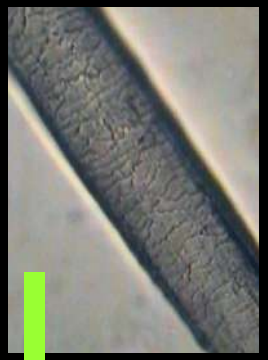



Dog


Rabbit




Rat

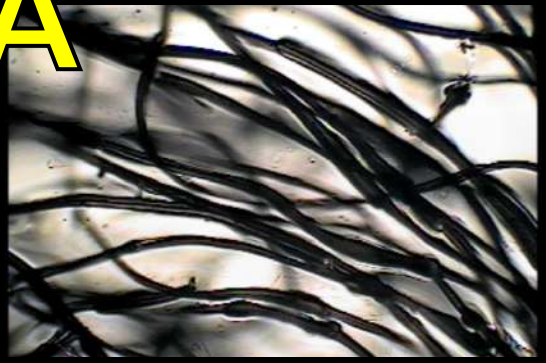



Human

# Types of Fibers - Key

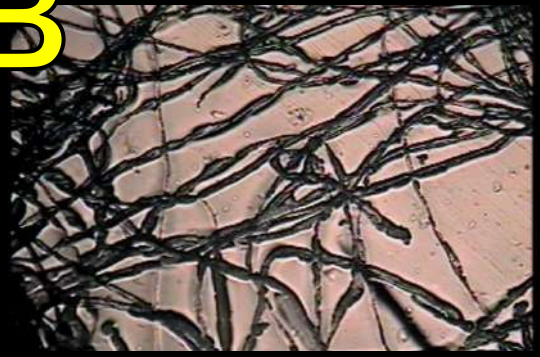
A

Yarn



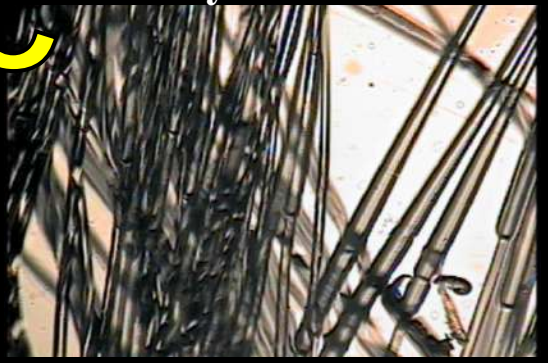
B

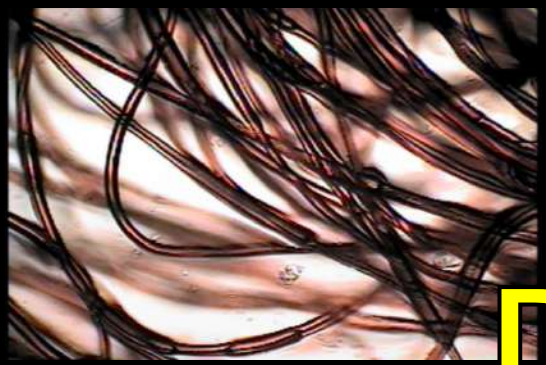
Cotton



C

Nylon



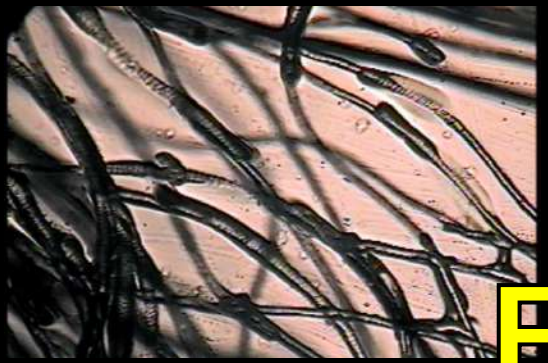


D

Polyester

E

Rayon



F

Wool

A. Race
B. Drugs
C. Place
D. origin

A. Shaft
B. Medulla
C. Cuticle
D. Follicle

A. Medulla
B. Cuticle
C. Follicle
D. Cortex

A. Comparison
B. Scanning
C. Light
D. Transmission

A. Continuous
B. Anagenic
C. Fragmented
D. None of the above

A. Cortex
B. Cuticle
C. Medulla
D. Medullary Index

A. Anagen
B. Catagen
C. Metagen
D. Telogen

A. Cuticle index
B. Scale structure
C. Medullary index
D. Medullary shape

A. Matching the color
B. DNA Analysis
C. Studying pigment granules
D. Measuring the medullary index

A. 1 cm
B. 2 cm
C. .1 cm
D. .2 cm