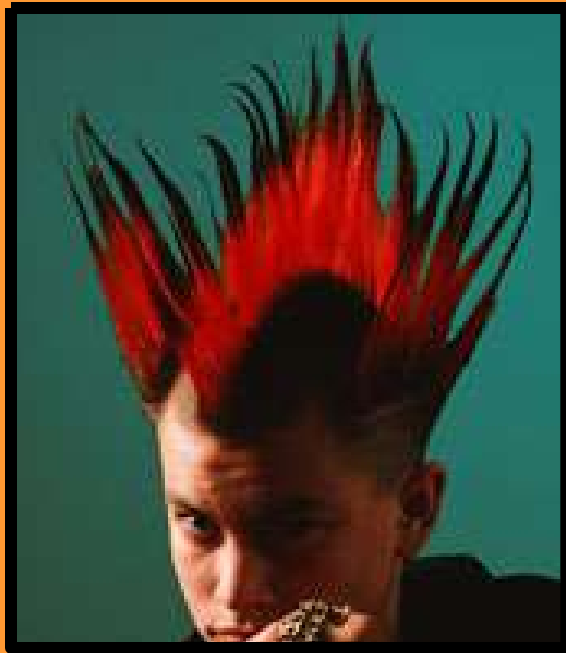


# Hair & Fiber Analysis



# **Hair & Fiber Analysis**

- **Can be used to match a suspect with a crime scene**
- **Can be microscopically analyzed for similarity**
- **Comparisons continue to improve as forensic techniques improve**

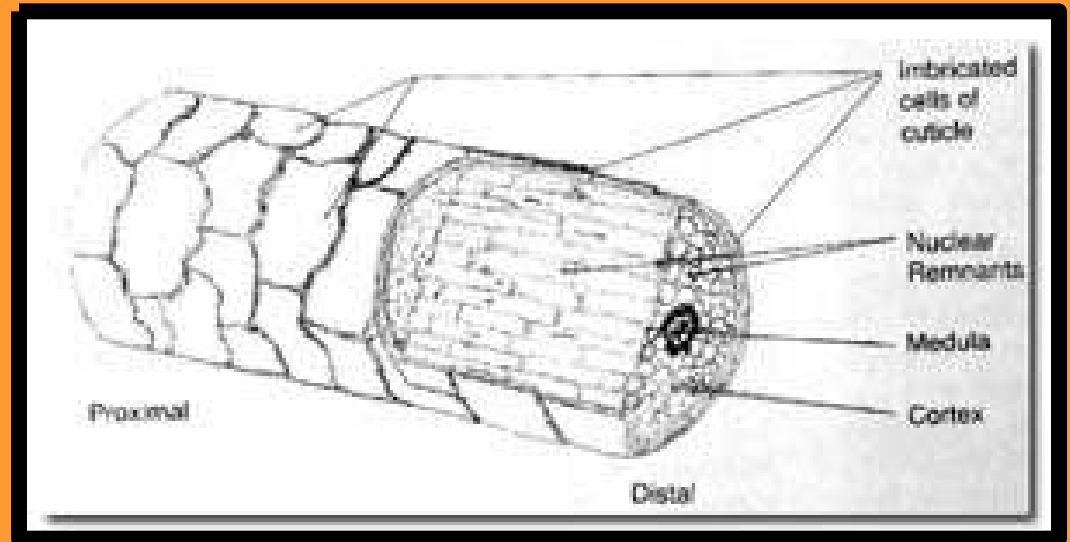
# **Part 1 Hair Background**

- **Grows from a collection of cells called a follicle**
- **The hair shaft is composed of three parts:**
  - 1.cuticle – outside covering of hair shaft, can look like overlapping roof shingles**

**2. Cortex – inside the cuticle, a pigmented layer**

**3. Medulla – runs down the center of the hair shaft**

**shaft**



# Hair Through the Microscope

## Student Text

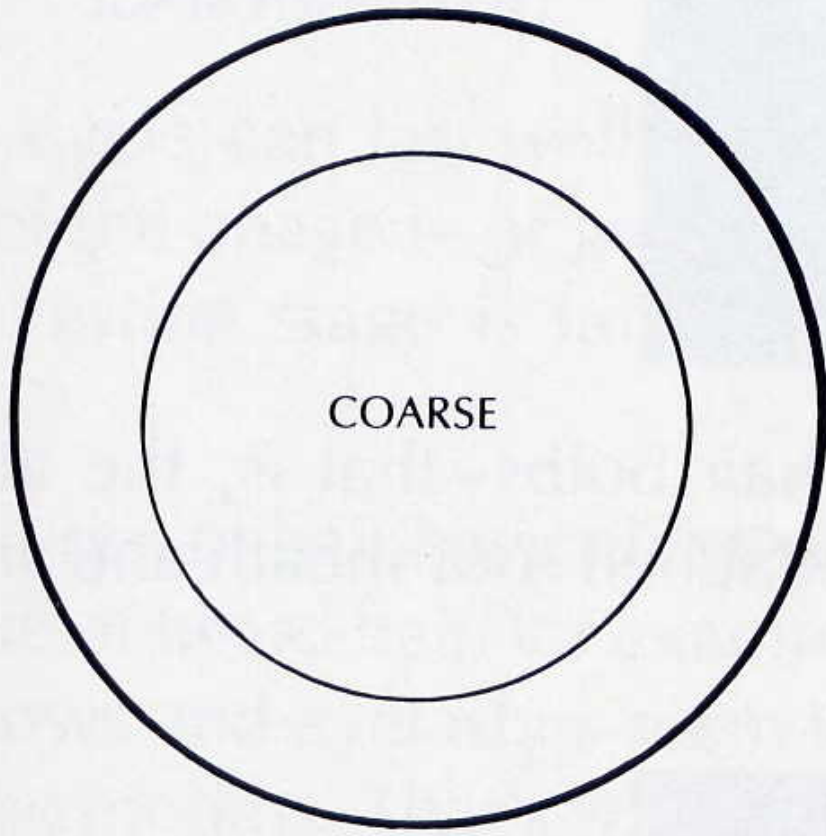


Student Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Phone: \_\_\_\_\_

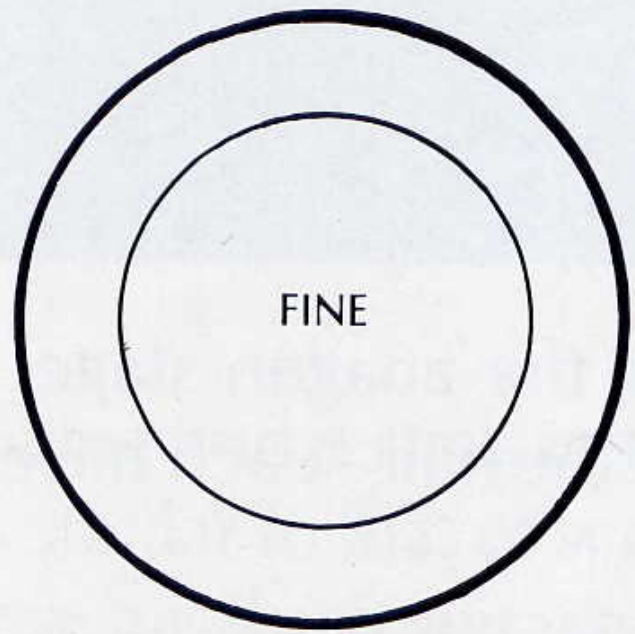
**Many photos can  
be obtained from  
hair dressing  
publications.**

**Many of the  
following are from  
this publication.**

**Hair texture can vary  
considerably  
depending upon the  
ratio of cuticle to  
medulla**



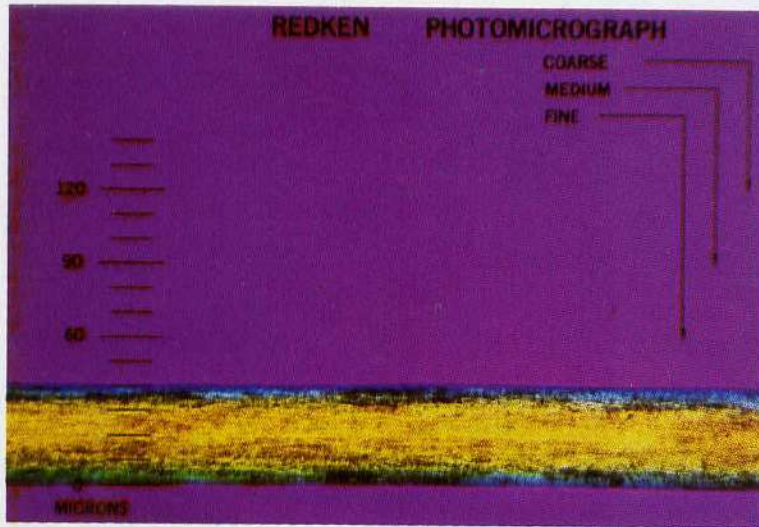
CUTICLE = 10%



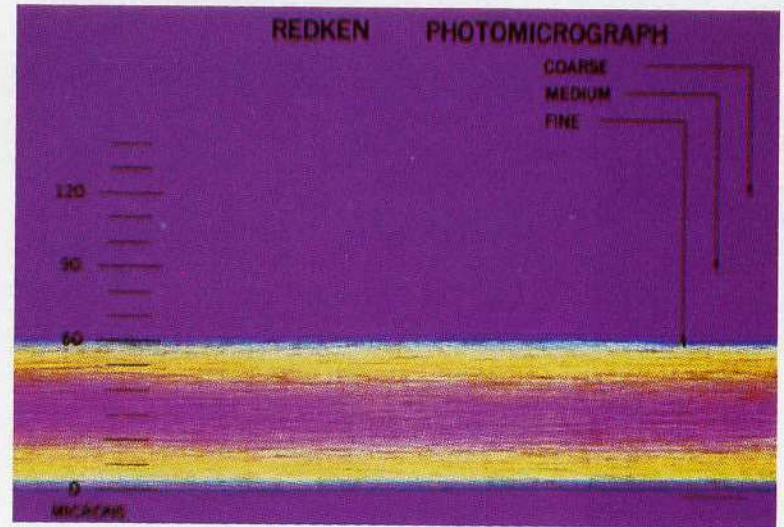
CUTICLE = 20-40%

AVERAGE CUTICLE/CORTEX RATIO

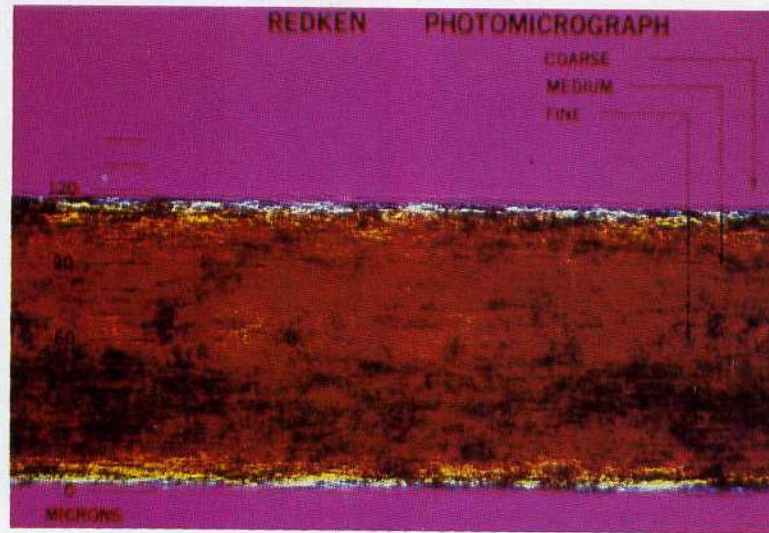




FINE



MEDIUM



COARSE

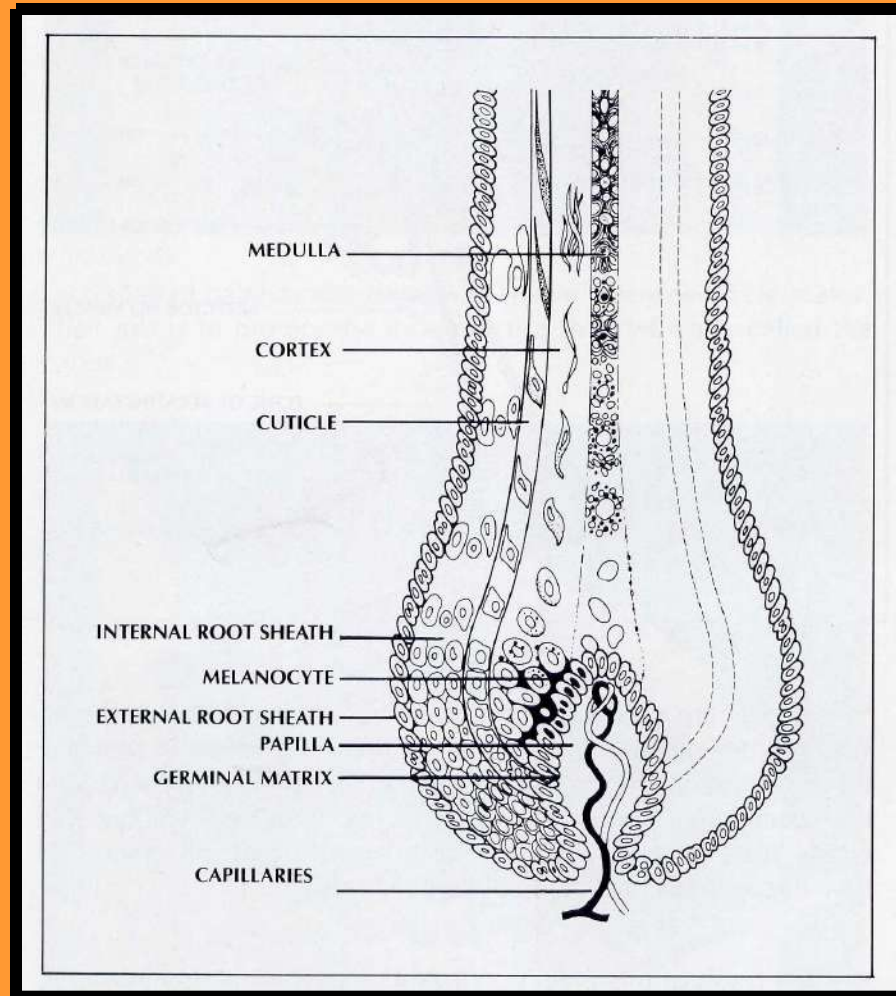


# THE BIOLOGY OF HAIR

Hair... We all know it grows... It can be damaged either by nature or improper care... Its color can be changed... But, have you ever wondered what makes all this possible? The answers lie in the marvelous, mysterious biology of living matter.



# How a hair grows



# **Hair fibers are excellent for ID study because:**

- **They resist decomposition**
- **May indicate drug use or poisoning**



# To distinguish between animal and human hair use a Medullary Index

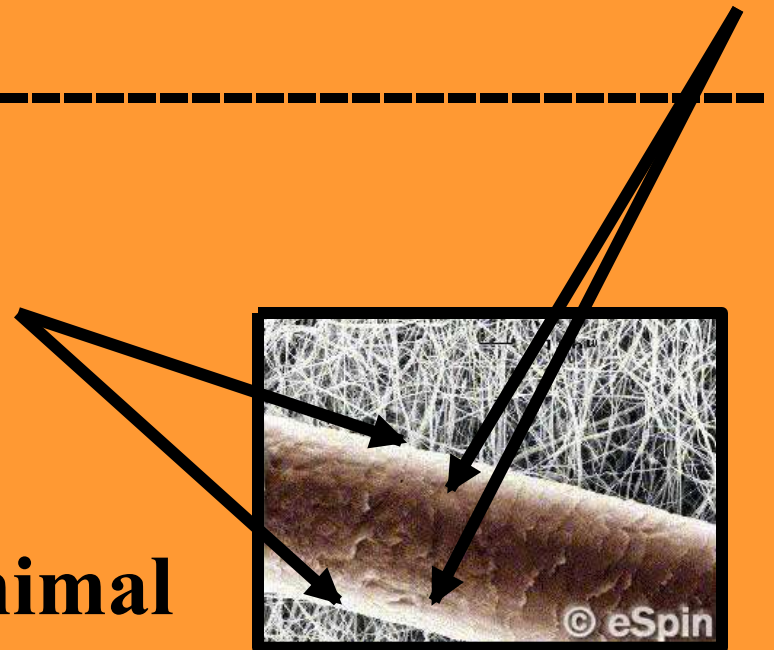
diameter of hair's medulla

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

diameter of the hair

M.I. =  $<.33$  hair is human

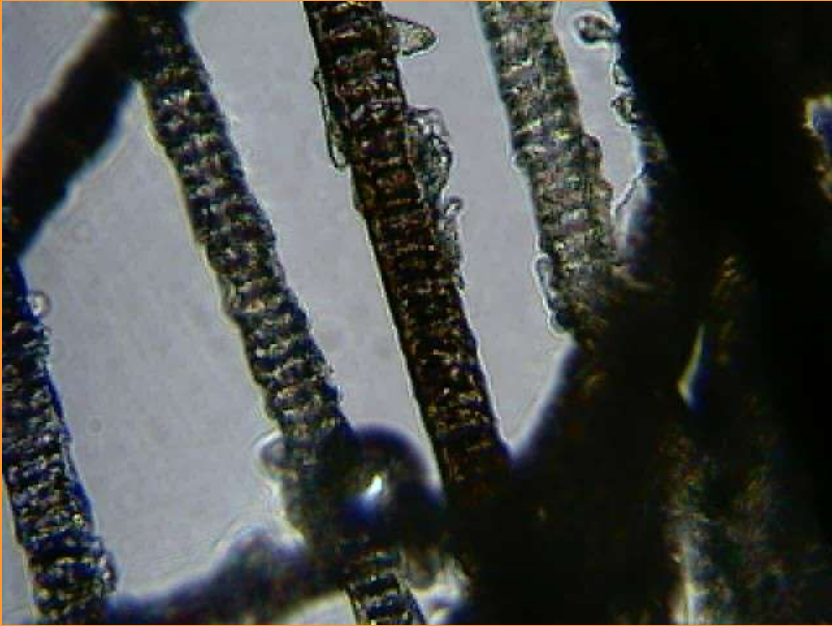
M.I. =  $>.5$  or more, hair is animal



**Appearance of  
different hair (or  
fur) types will vary  
from animal to  
animal**

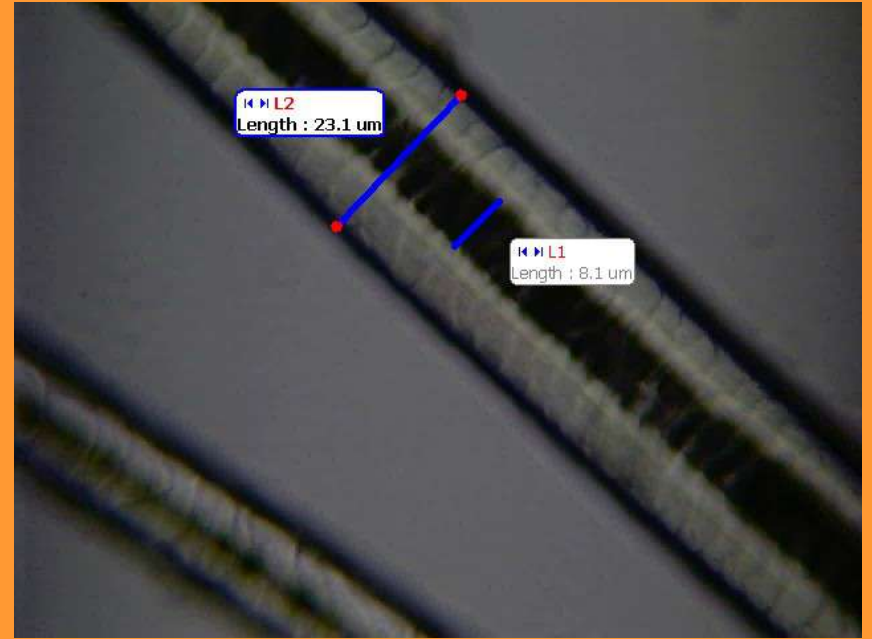




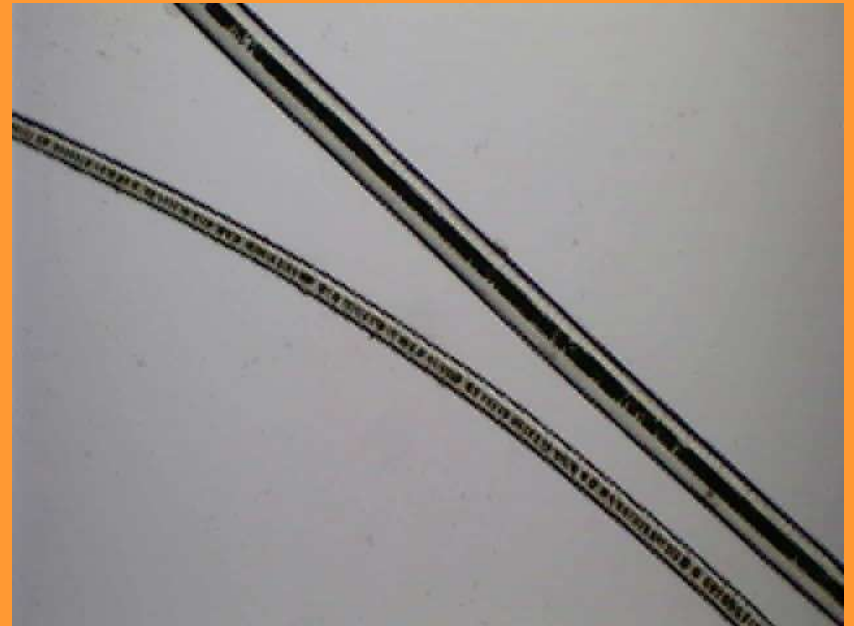


# Cat hair



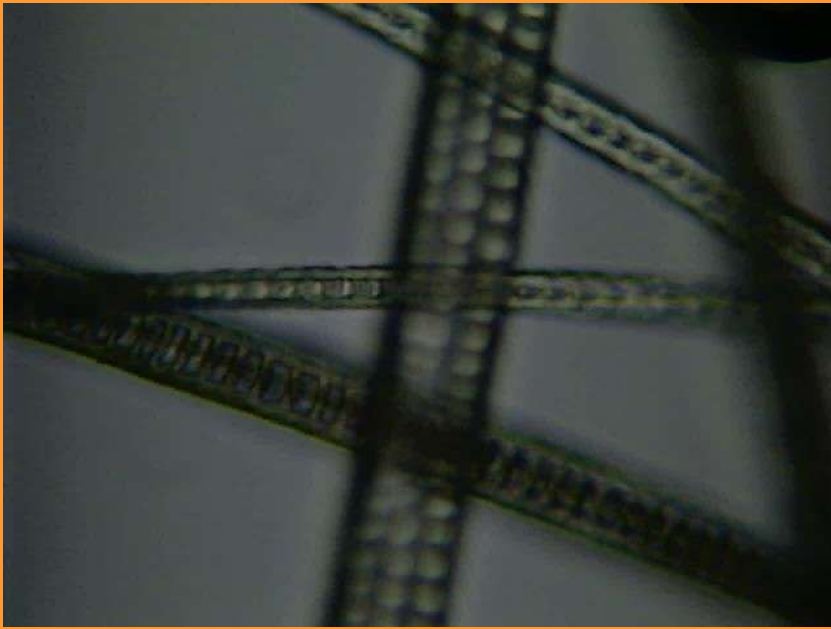


# Dog hair





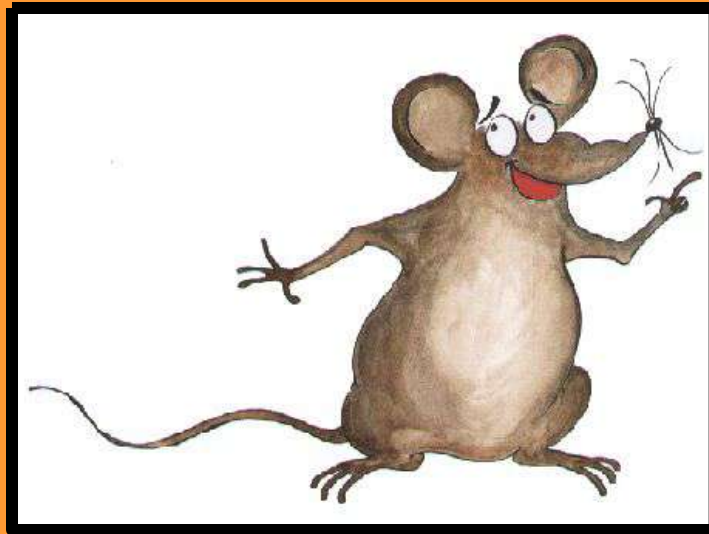
# Rabbit hair

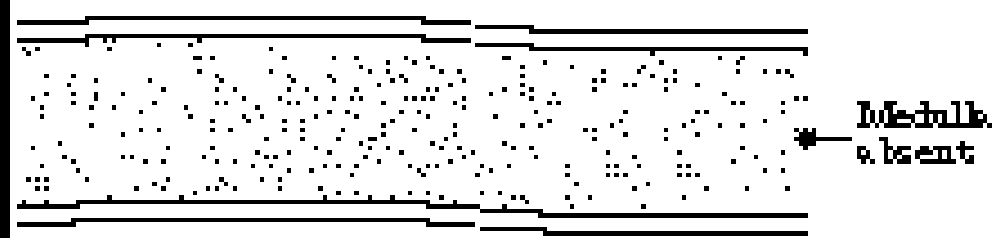
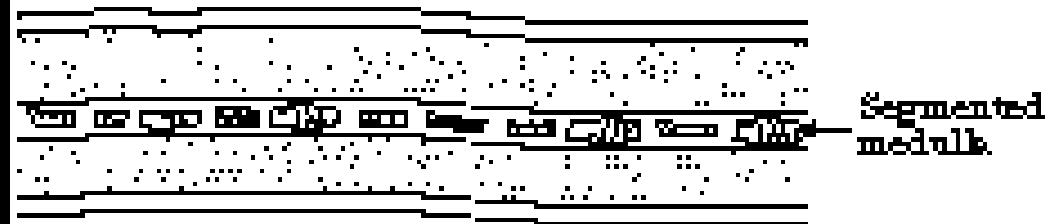


# Other animal hair



- **Deer – no cortex, medulla filled with spheres**
- **Mouse – parallel rows of beads**





*Figure 9. Types of hair.*

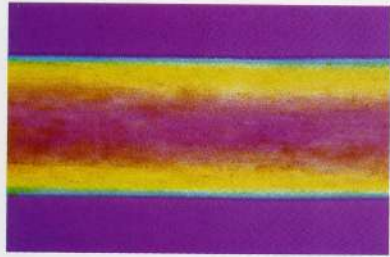
# **Human Medullary Patterns has three types:**

- **Continuous medullary canal**
- **Interrupted medulla  
(regular interruption)**
- **Fragmented medulla  
(interruption irregular)**

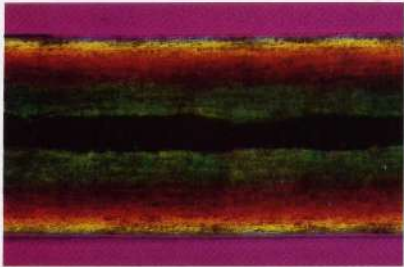
# Hair Photos

- Can you identify the type of medullary pattern- continuous, interrupted and fragmented?

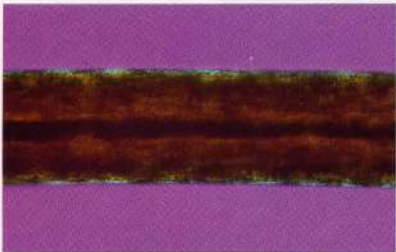




**Caucasoid**



**Oriental**



**Negroid**



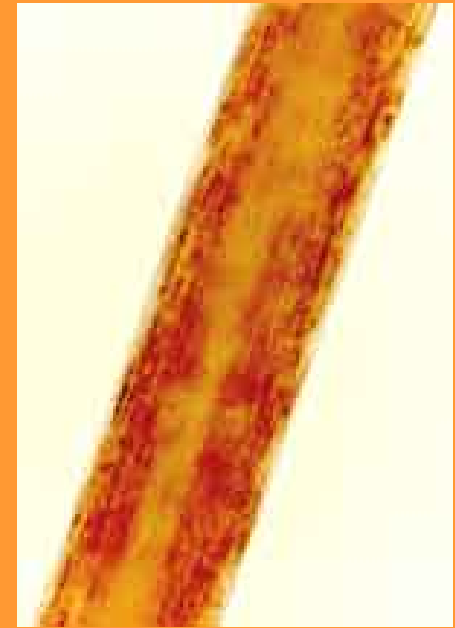
# Hair from different races



**Negroid**



**Mongoloid**

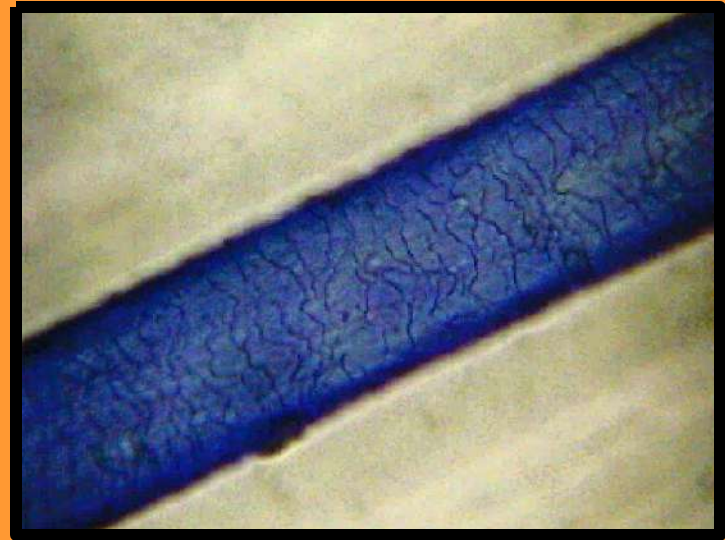
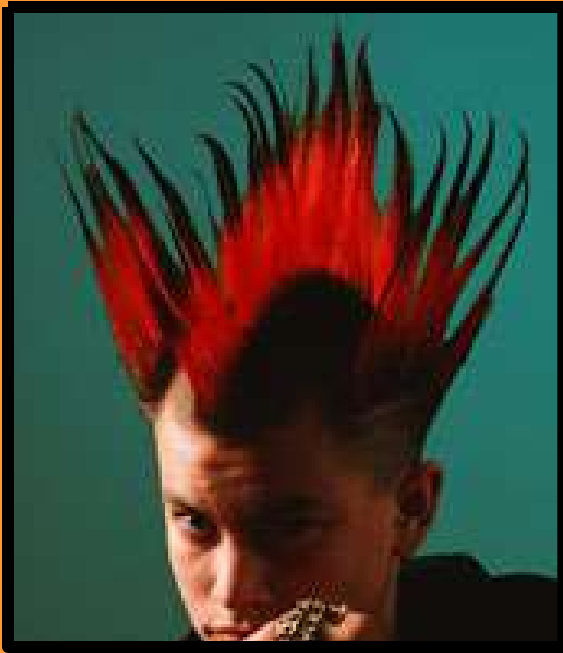


**Caucasoid**

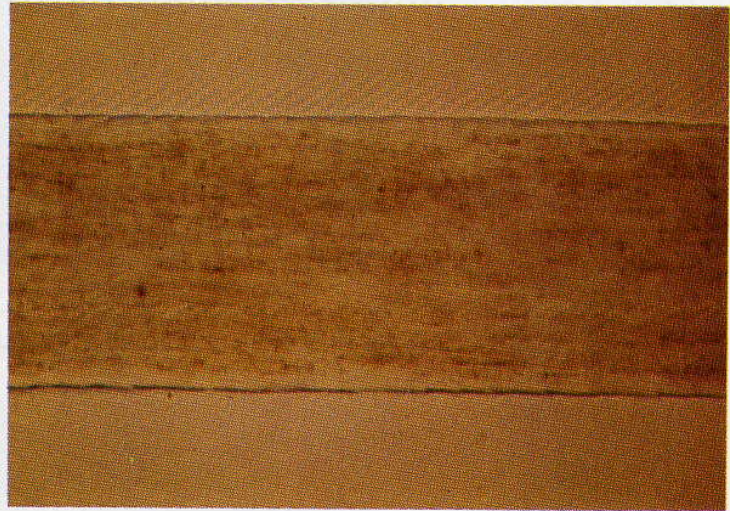
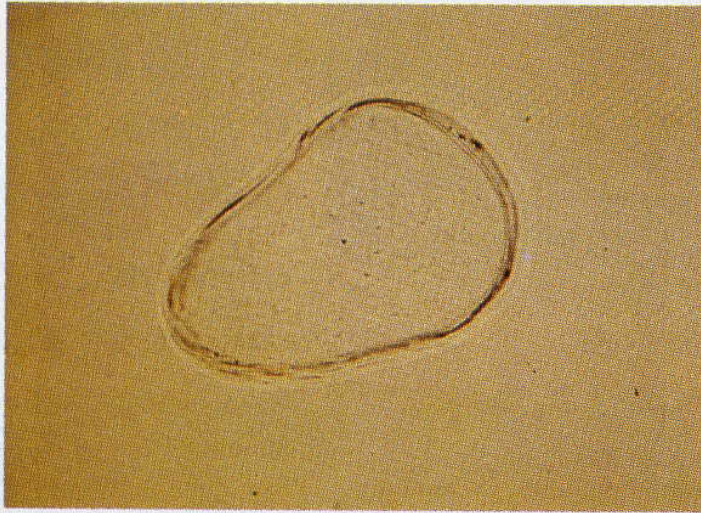
**Hair cannot be absolutely identified as to race. Traits associated are often and characteristics of races are less distinct.**



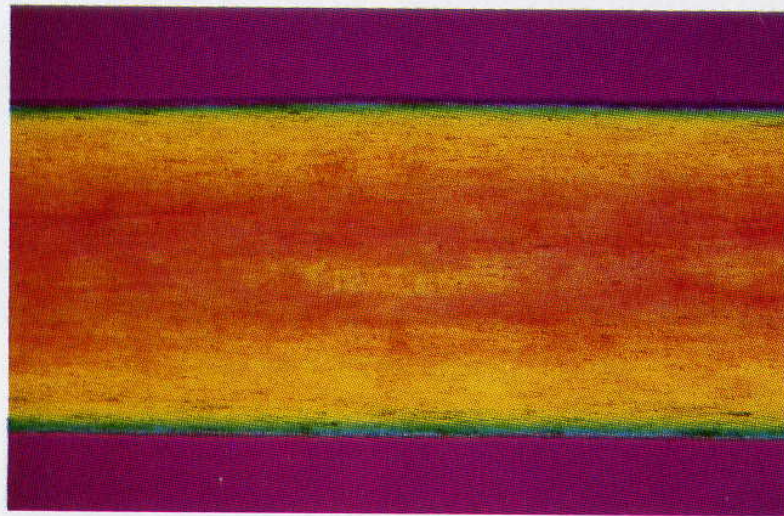
# Some Caucasoid natural colors





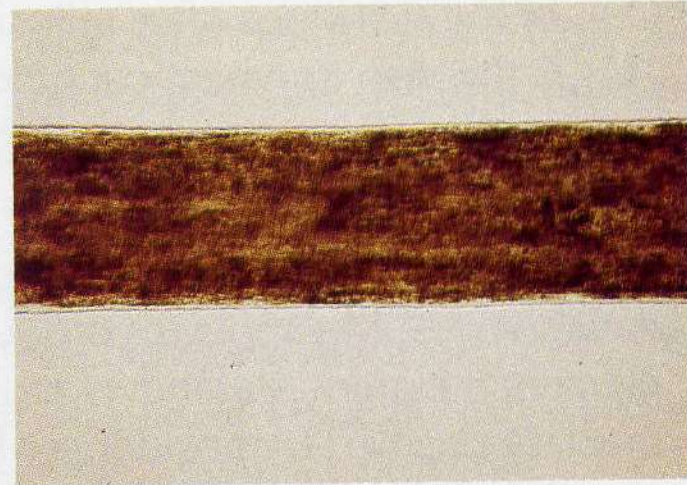
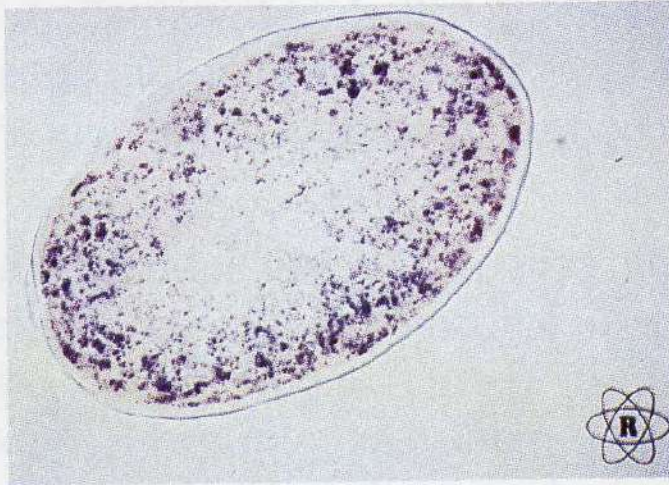


VIEWED UNDER LIGHT MICROSCOPE

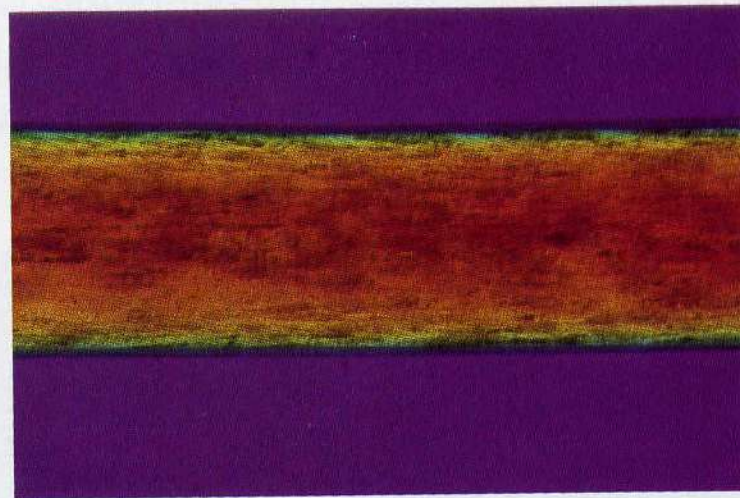


POLARIZED LIGHT MICROSCOPE  
BLONDE HAIR





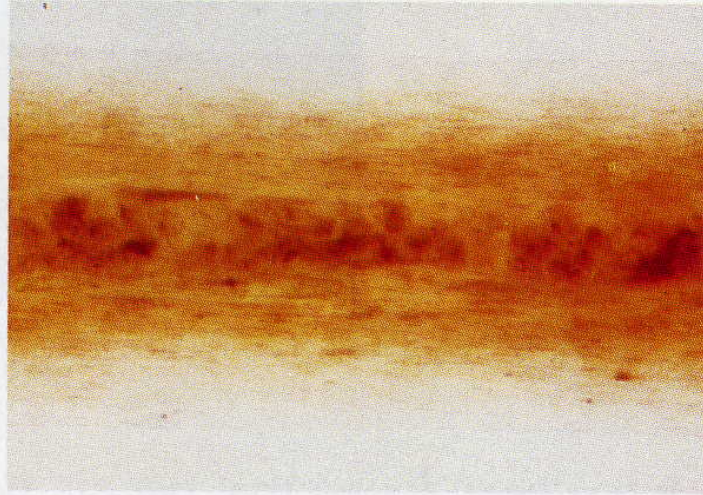
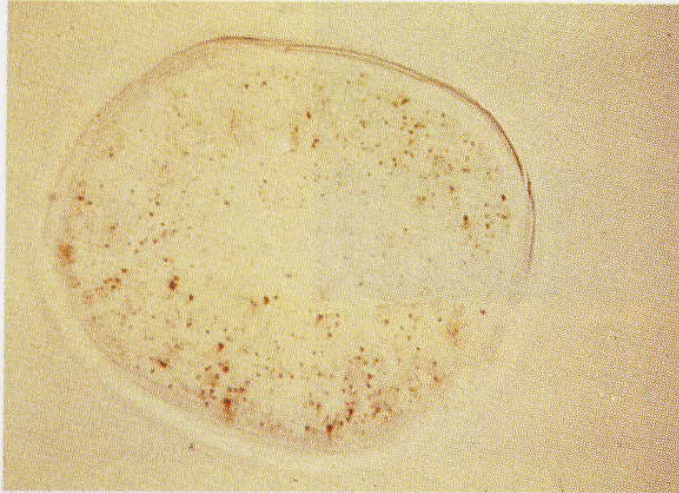
VIEWED UNDER LIGHT MICROSCOPE



POLARIZED LIGHT MICROSCOPE  
BROWN HAIR



BLONDE HAIR

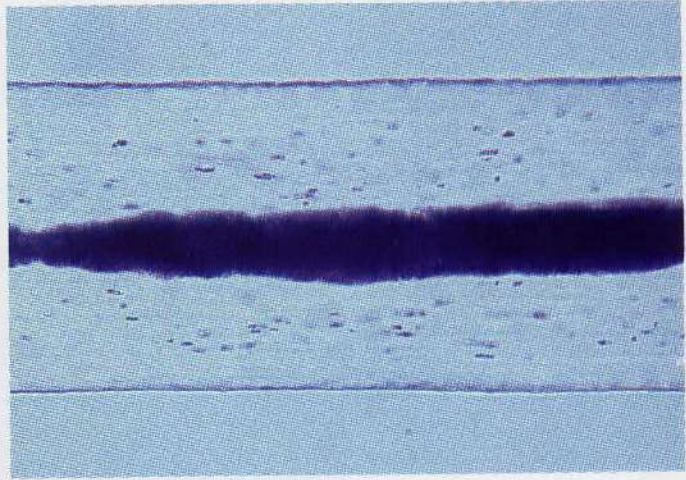
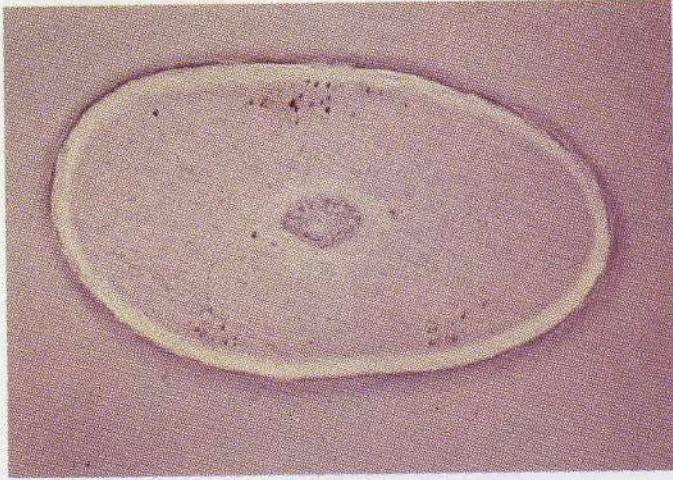


VIEWED UNDER LIGHT MICROSCOPE

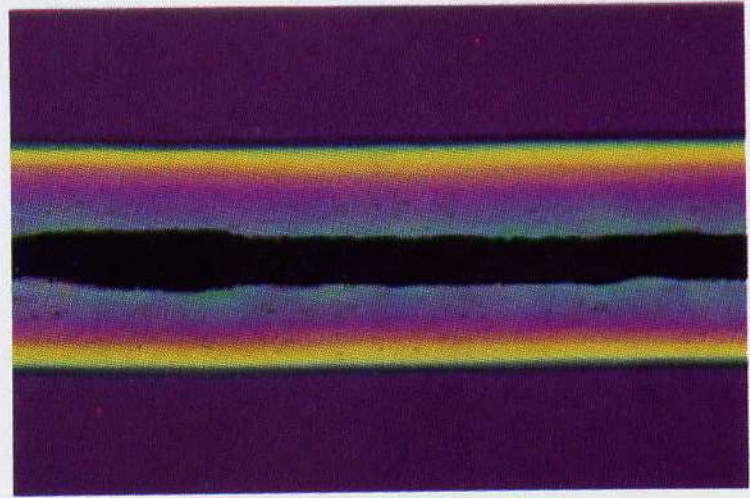


POLARIZED LIGHT  
RED HAIR





VIEWED UNDER LIGHT MICROSCOPE



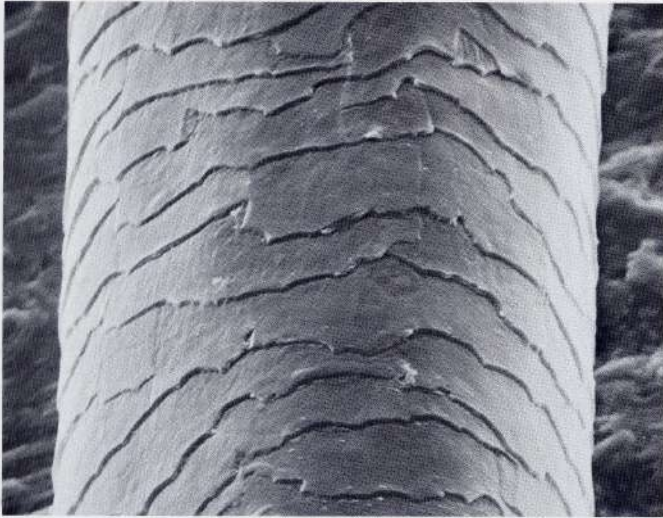
POLARIZED LIGHT  
WHITE HAIR



# **Additional Information**

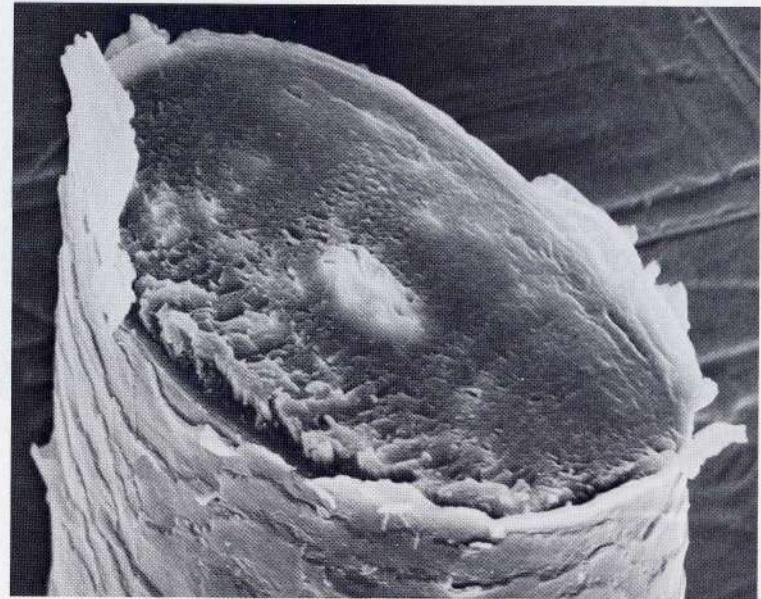
- Individuals of Oriental origin usually have a continuous medulla**
- Dyed hair shows color distributed in cortex and medulla**
- Bleached hair has a yellowish tint**
- As hair grows, natural color returns**

# Normal hair



CUTICLE SCALES

Each shaft of hair has about seven to twelve layers of cuticle scales. Their job is to protect the inside of the shaft which is called the cortex.

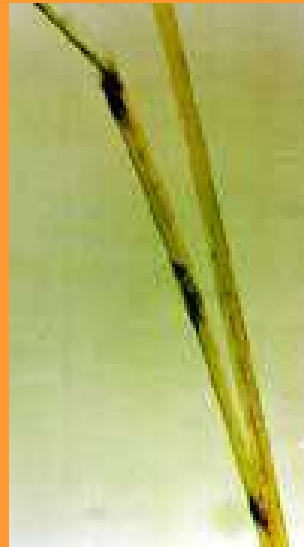


NORMAL CORTEX

# Damaged hair



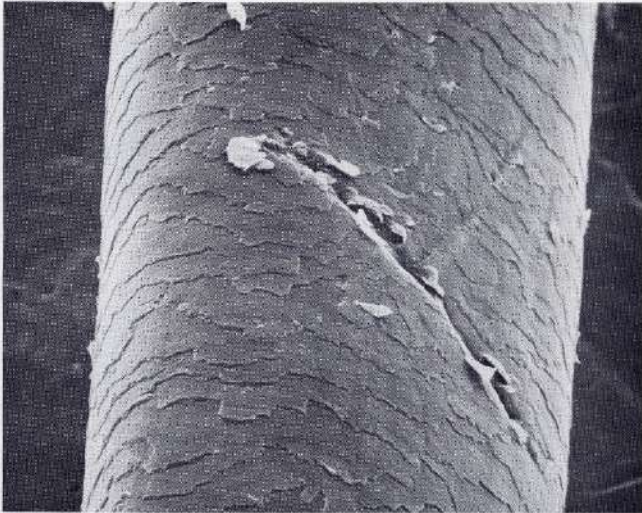
**Burned**



**Split ends**

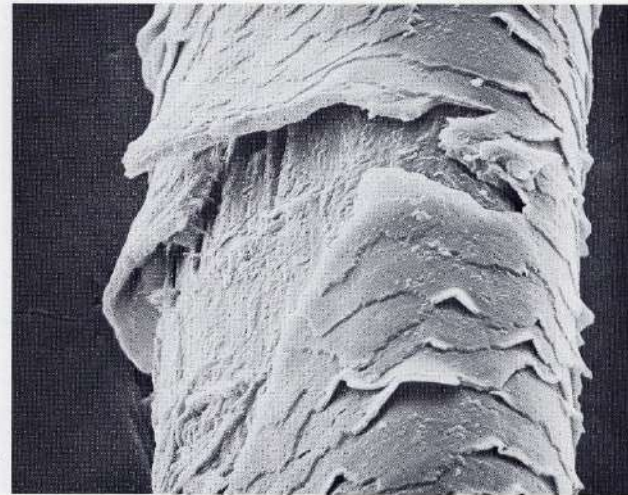


**Razor cut**



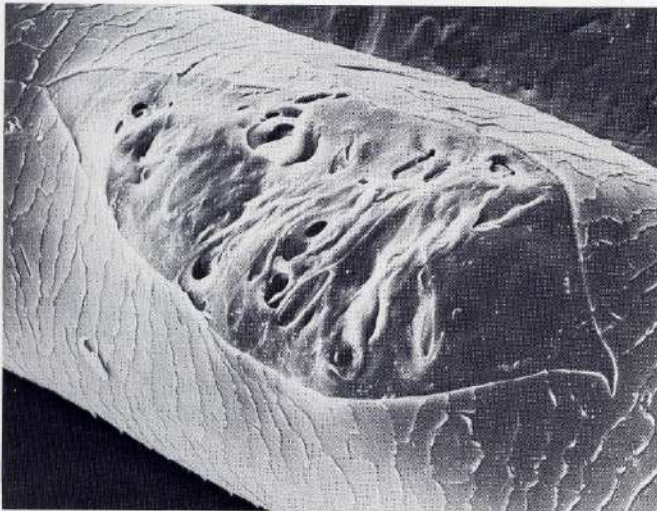
DAMAGED CUTICLE

So can wrapping it too tightly around a roller.

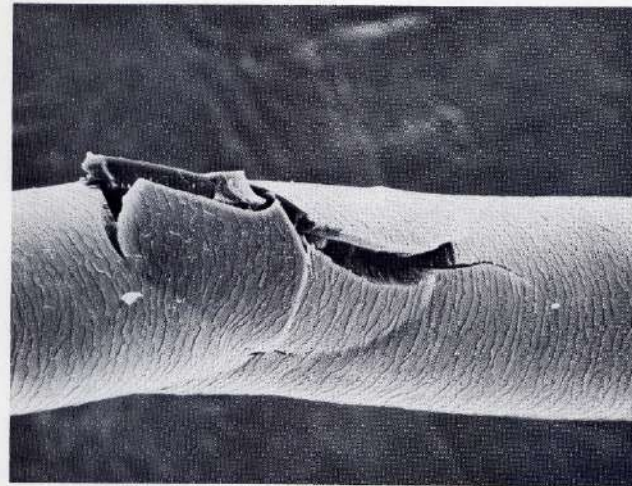


ABRADED AND BROKEN CUTICLE

Rubber bands, tight hair clips and braids can actually break the cuticle.

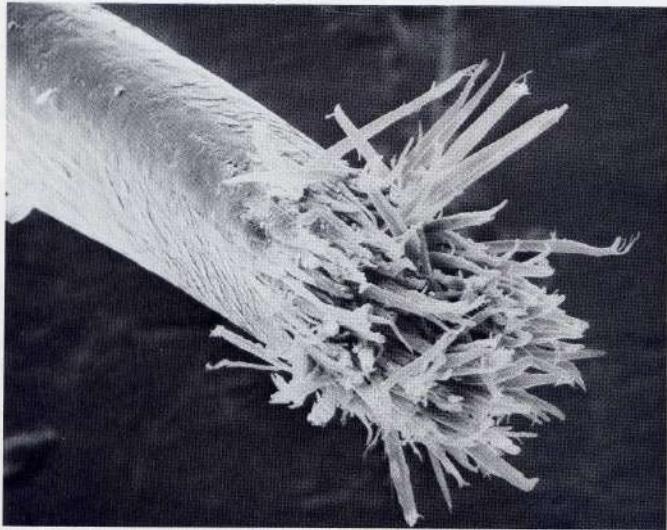


BLISTER

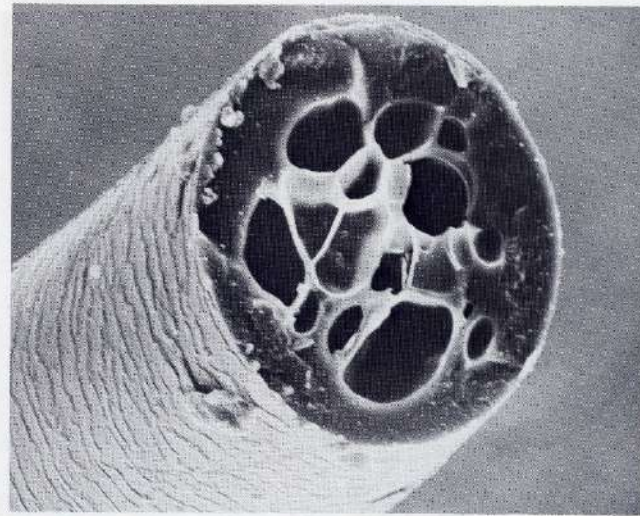


FRACTURED HAIR SHAFT

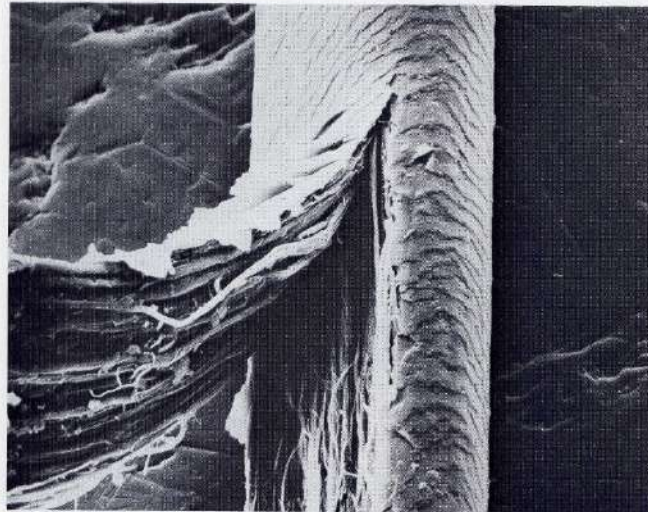




FRAYED CORTEX  
(SPLIT END)



MELTED CORTEX



FRACTURED CORTEX



# **Hair is**

**‘class evidence’ not individual evidence**

**What’s the difference?**

**Varies in texture from one region of the  
body to another**

**Round or oval in cross-section in**

**Caucasians**

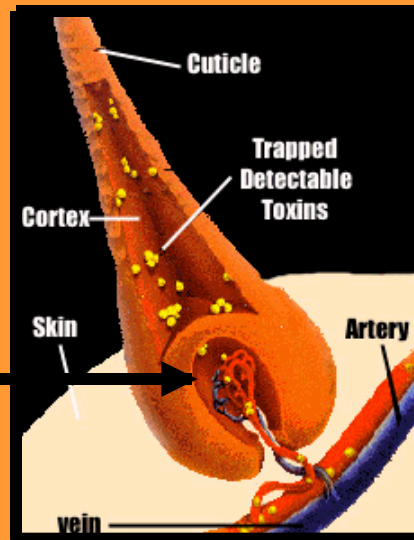
**Oval or flat in cross-section in African**

**Americans**

# DNA Analysis

- Only possible if ‘bulb’ at the base of the hair is intact

**Bulb**





# Forcibly removed



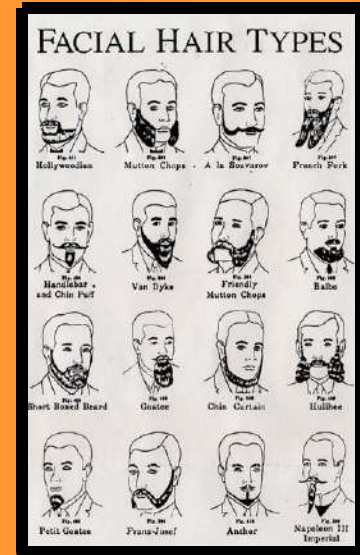
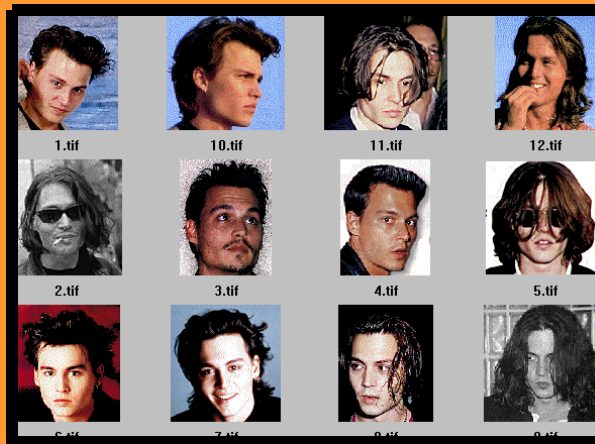
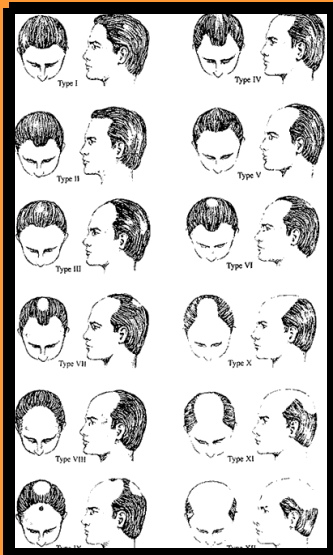
**Follicle intact**



**Pulled**

# A Baseline

Up to 50 hairs from each body region (head, pubic area, facial hair, etc.), are needed to provide a baseline for comparability



# Pubic hair



# Forensic Examination

- **Obtain samples of crime scene hair samples and compare them microscopically with fibers from four suspects**
- **Complete the lab worksheets available**

