

Hair Evidence and Analysis



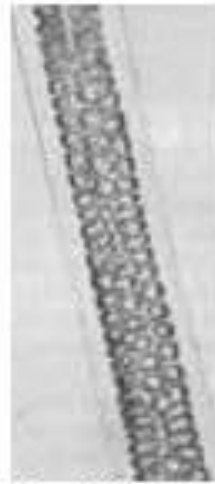
Human



Dog



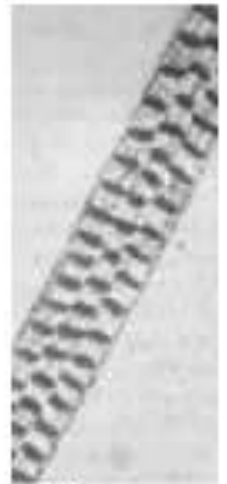
Deer



Rabbit



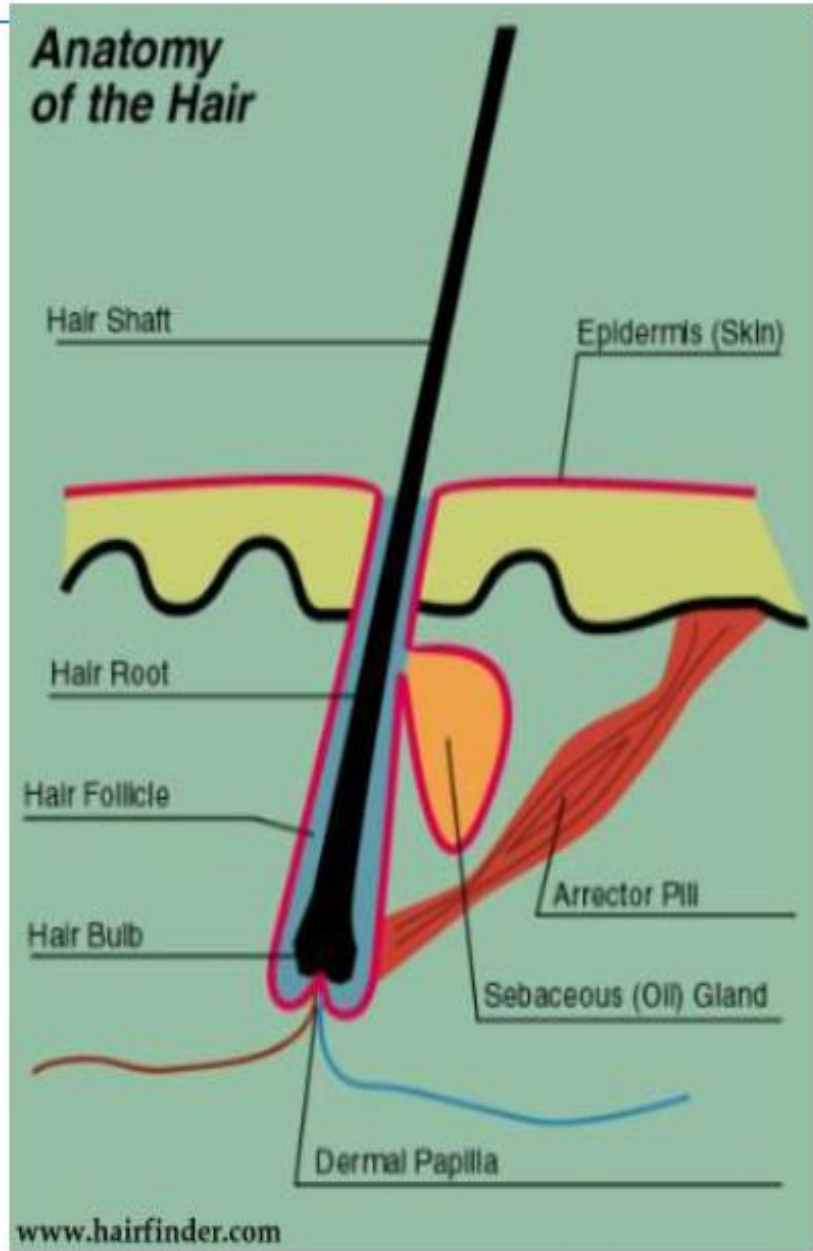
Cat



Mouse

Structure of Hair

- Outgrowth of the skin
- Hair is made of **dead** cells that have a hard protein coating, called **keratin** on the outer layer.
- Hair grows out of the **follicle** (new cells push the old ones **up and out**).

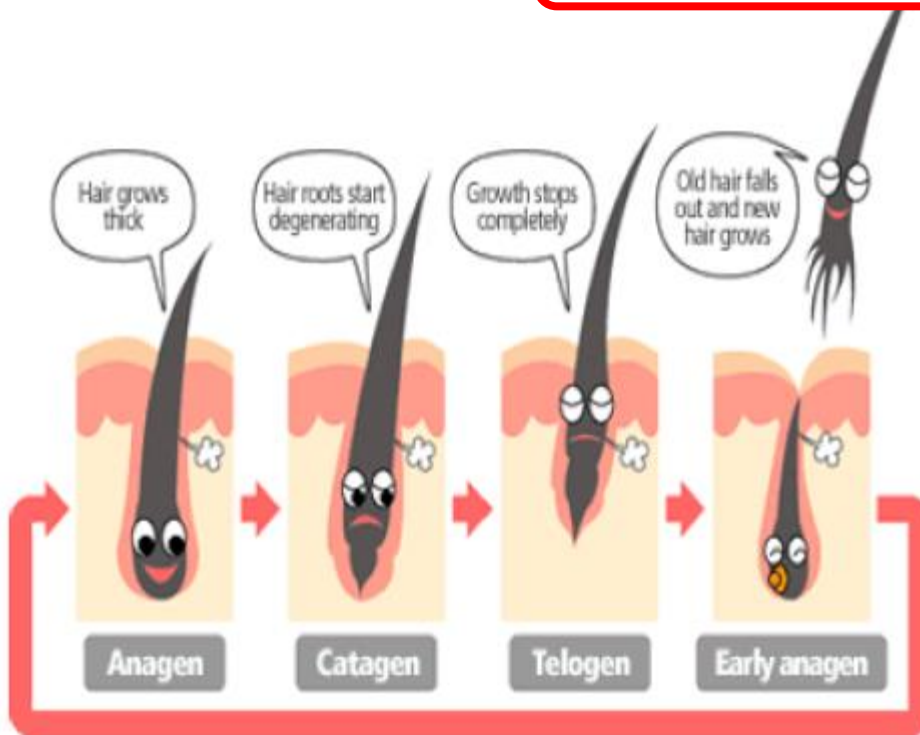


Hair Growth

- Grows approximately 0.5 inch per month
- You lose about 35-40 hairs/ day

Hair Life Cycle:

1. **ANAGEN** – hair grows
2. **CATAGEN** – root starts degenerating
3. **TELOGEN** – growth completely stops/old hair falls



Hair Life Cycle

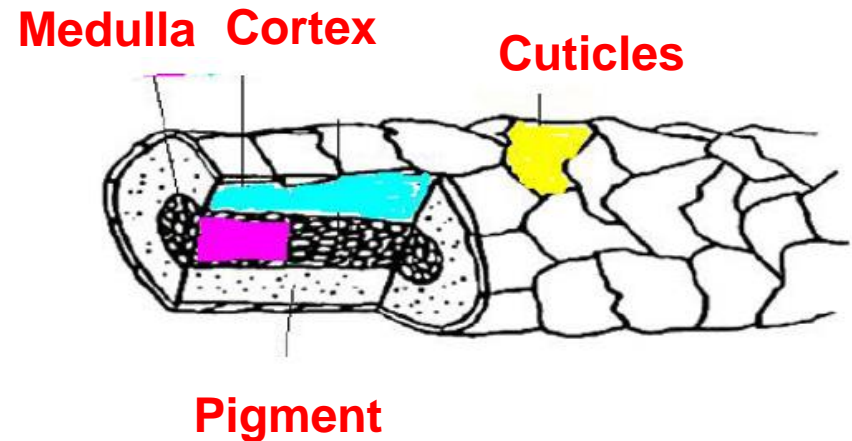
Hair Structure

Hair is composed 3 main parts :

Cuticle—outside covering,
made of overlapping scales

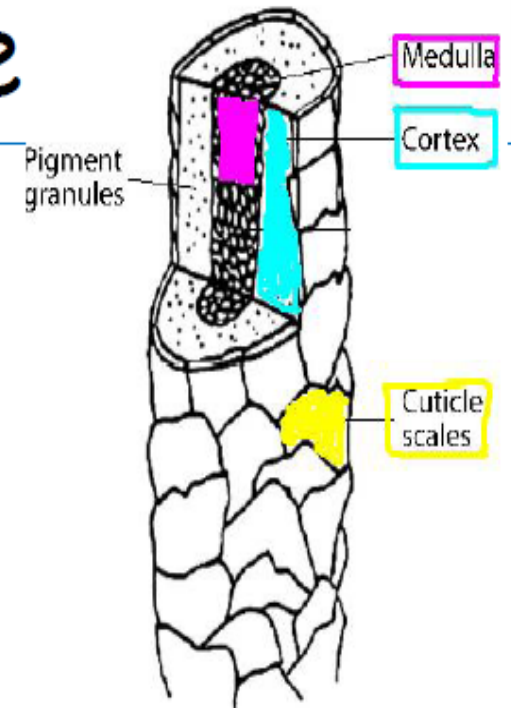
Cortex—inner layer made of
keratin and imbedded with
pigment

Medulla—inside layer running
down the center of the
cortex



The Cuticle

- outermost layer of hair which is covered with **scales**.
- The scales point toward the **tip** of the hair.
- **IMPORTANCE:** Scales **differ** between species of animals



- *The three basic patterns are:*



CORONAL



SPINUOUS



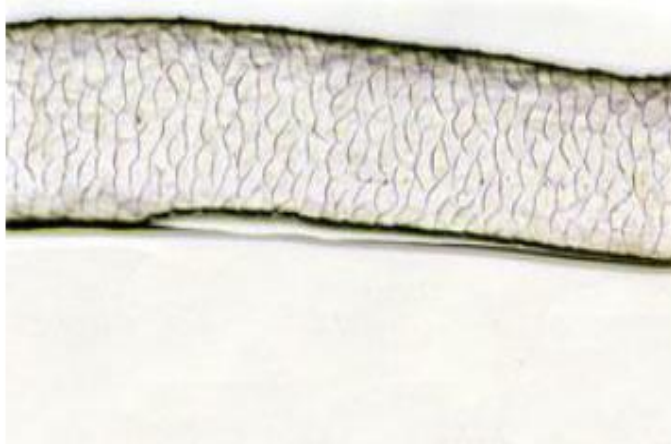
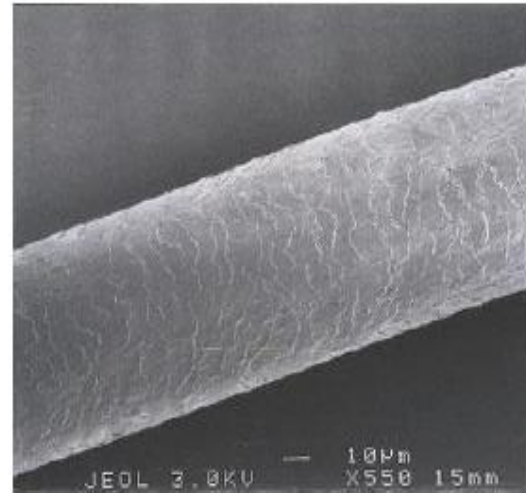
IMBRICATE

Cuticle (scales) Comparisons

Scales on bat hair

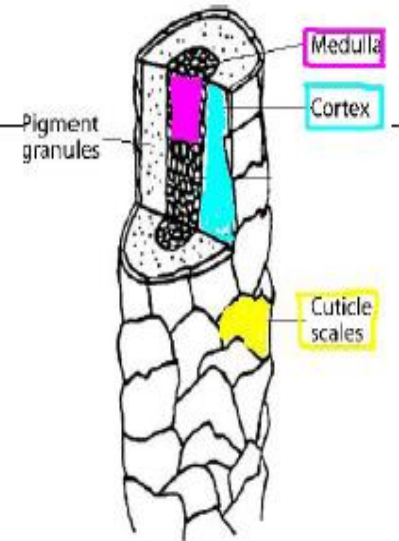


Scales on human hair



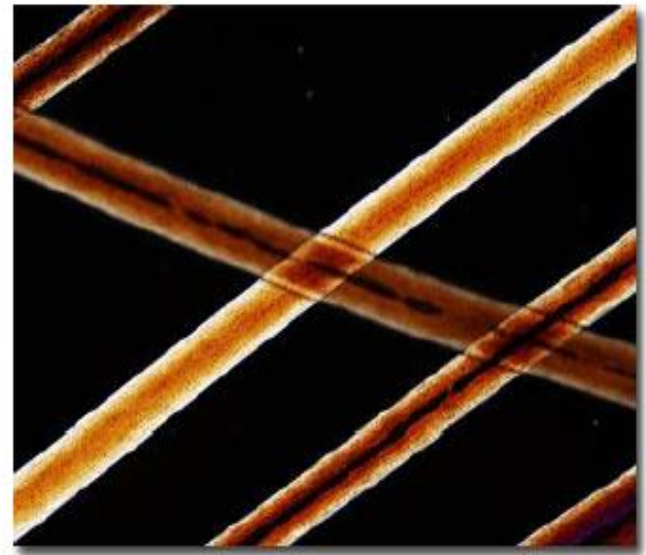
Scales on moose hair

The Cortex



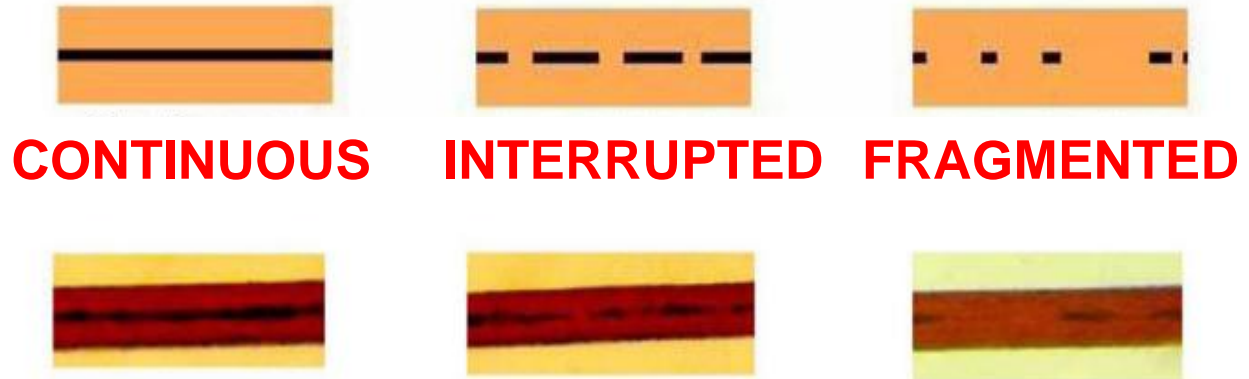
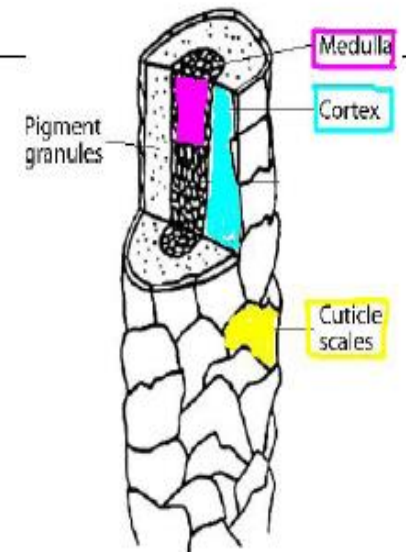
- gives the hair its **color**

- IMPORTANCE: **Melanin**—pigment granules that give hair its color and a good point of comparison.



The Medulla

- The medulla is the hair core that is not always visible.
- **IMPORTANCE:** The medulla comes in different types, patterns, and thickness.



Images from *Brennon Sapp* and *bsapp.com*.

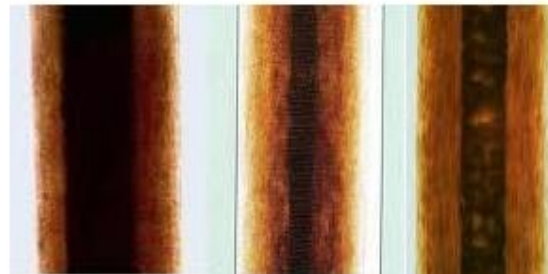
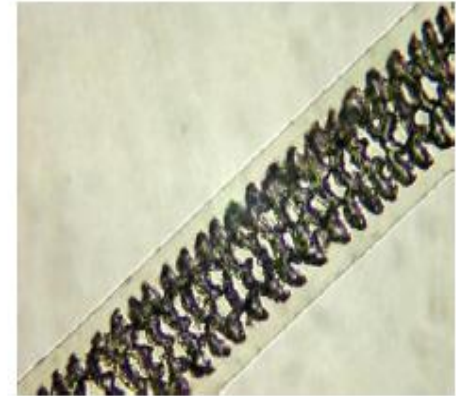
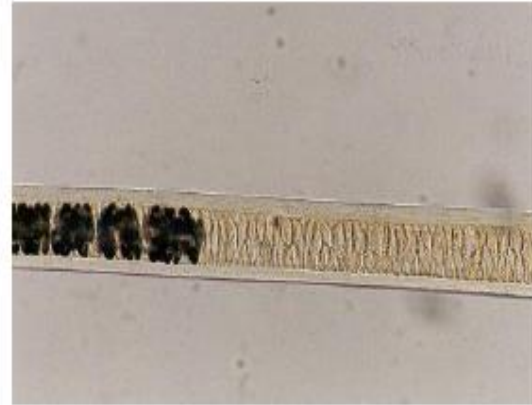
Medulla Comparisons

- Humans have a **small medulla** (less than $1/3$ of the hair diameter)
- Animals have **larger medulla** ($1/2$ hair diameter +)
- Medullas in animals sometimes exhibit patterned shapes (humans are usually cylindrical)



Images from *Brennon Sapp and bsapp.com*.

Ex of Animal Hair- medulla size and shape



Unknown

Chimpanzee

Black Bear

Forcible Removal of Hair



Naturally shed hairs = undamaged, club-shaped roots.



Forcibly removed hairs = may have tissues attached



Forcibly removed hairs = may have stretched root

Hair Analysis

- It's usually **class evidence**
 - unless **DNA in root** is found (can sometimes do mtDNA testing)
- Hair even **varies** within a single person
- Hair is found only in **mammals**



What can be determined from hair:

- If the source is human or animal
- Race (sometimes)
- **Origin** of the location on the source's body
- Whether the hair was forcibly removed
- If the hair has been treated with **chemicals**
- If **drugs** have been ingested or if person has been exposed to **toxins**
- Individualized if root is present (DNA)

Things hair can't determine:

- **Age** (except infant hair)
- **Gender** (unless DNA in root)



Collection of Hair

- Questioned hairs must be accompanied by an adequate number of control samples.
 - from victim
 - from possible suspects
 - from others who may have deposited hair at the scene
- Control Sample
 - 50 full-length hairs from all areas of scalp
 - 24 full-length pubic hairs



Tools of the Trade

View of hairs
using a
comparison-light
microscope

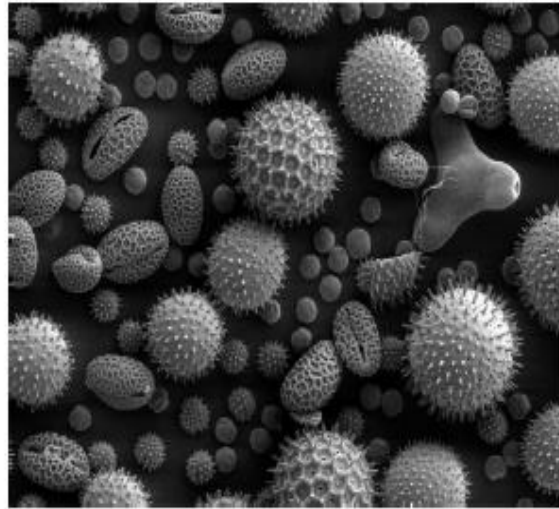


comparison-light
microscope

\$1850 +

Scanning Electron Microscope

- Uses electron beam
- Up to 100,000 x



pollen

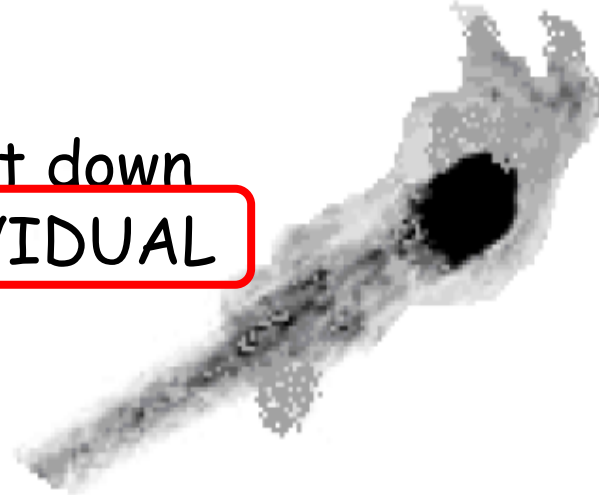


Individualizing Hair (DNA)

- Nuclear DNA (in the root).



Can narrow it down
to an **INDIVIDUAL**



Mitochondrial DNA (mtDNA)

- Hair shaft contains abundant inherited only from the mother.
- Process is more difficult and costly than using nuclear DNA.
- Can only narrow it down to **siblings** not an **individual**

Review of the Microscope

Pre-Lab
Questions...



