

Name _____
Date _____

Structure of Hair

Forensics
Mr. Rizzo

The **hair shaft** is comprised of 3 different cell layers:

1. Cuticle:

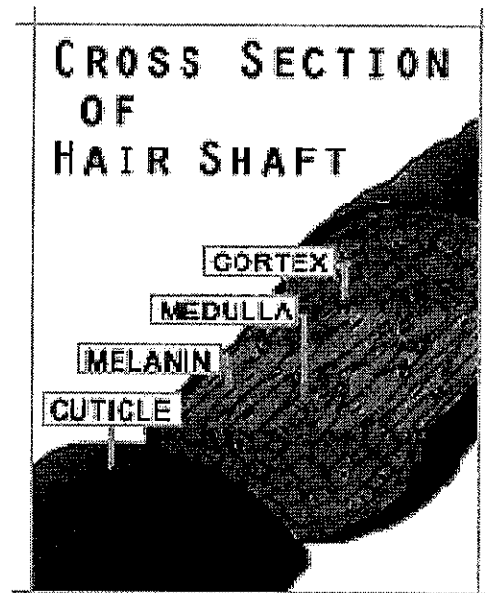
- Translucent outer layer, which protects the hair.
- Flat cells layered in an overlapping formation that looks like shingles on a roof.

2. Cortex:

- Middle layer made up of long thin cells firmly attached to each other and arranged lengthwise.
- Location where nature creates natural hair coloring, a substance called melanin.
- Provides hair with strength, elasticity and determines the texture and quality of hair.

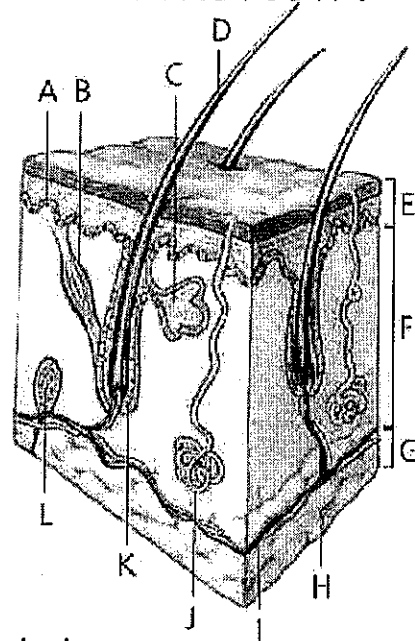
3. Medulla:

- Central core of the hair.
- Composed of soft keratin.



Cross-Section of Human Skin Review:

- A. Melanocyte
- B. Muscle
- C. Sebaceous gland
- D. Hair shaft
- E. Epidermis
- F. Dermis
- G. Subcutaneous tissue
- H. Fat
- I. Arterial blood vessel
- J. Sweat gland
- K. hair follicle
- L. Pacinian corpuscle



a. melanocyte: an epidermal cell that produces melanin

B. muscle: a body tissue consisting of long cells that contract when stimulated and produce motion

C. sebaceous gland: any of the small sacculated glands lodged in the substance of the derma, usu. opening into the hair follicles, and secreting an oily or greasy material composed in great part of fat which softens and lubricates the hair and skin

D. hair shaft: the part of a hair projecting beyond the skin

E. epidermis: the outer epithelial layer of the external integument of the animal body that is derived from the embryonic epiblast; specif : the outer nonsensitive and nonvascular layer of the skin that overlies the dermis

F. dermis: the sensitive vascular inner mesodermic layer of the skin -- called also corium, cutis

G. subcutaneous tissue: of or pertaining to tissue being, living, or made *under* the top layers of skin

H. fat: animal tissue consisting chiefly of cells distended with greasy or oily matter

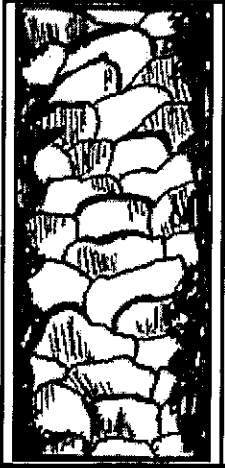
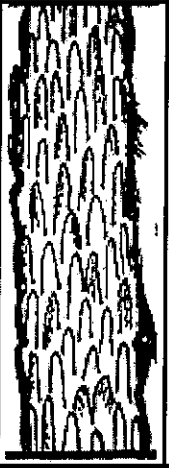
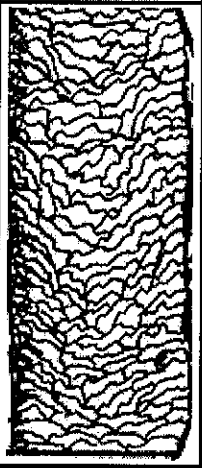
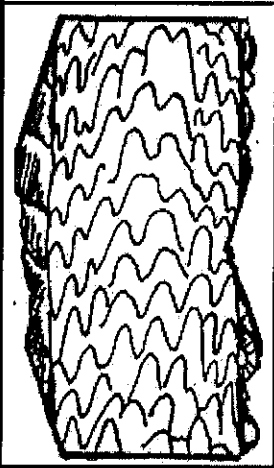

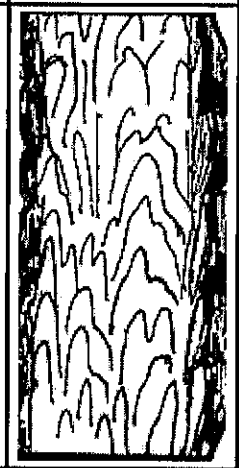
I. arterial blood vessel: any of the vessels through which bright red, oxygenated blood coming back from the lungs circulates in the body .

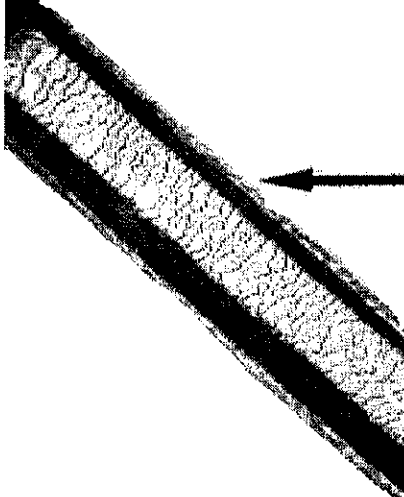
J. sweat gland: a simple tubular gland of the skin that secretes perspiration and in humans is widely distributed in nearly all parts of the skin -- called also sudoriferous gland

K. hair follicle: the tubular epithelial sheath that surrounds the lower part of the hair shaft and encloses at the bottom a vascular papilla supplying the growing basal part of the hair with nourishment

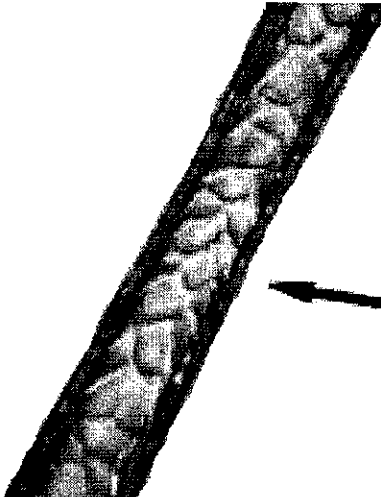
L. Pacinian corpuscle: an oval capsule that terminates some sensory nerve fibers esp. in the skin of the hands and feet

CUTICLE SCALES--Can you name the pattern found in each animal hair below?

Mosaic	Pectinate	Imbricate	Petal	Diamond Petal	Chevron
					

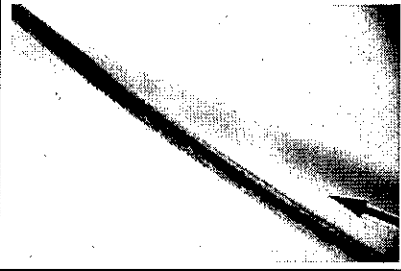
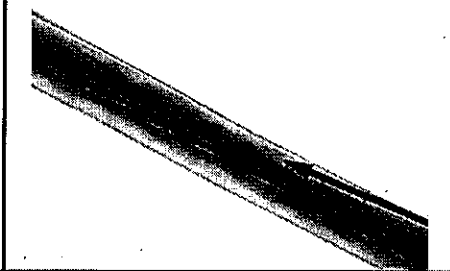

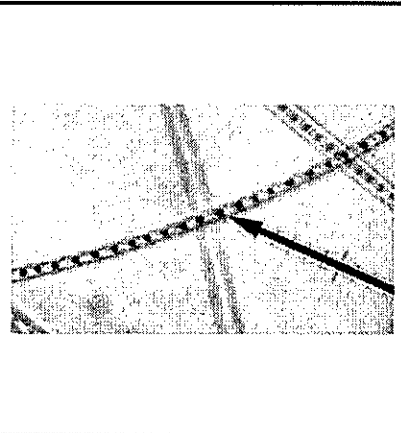
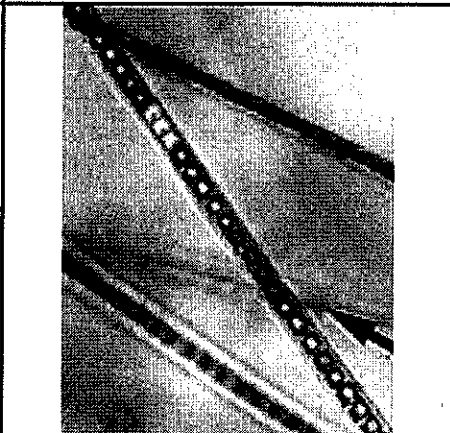
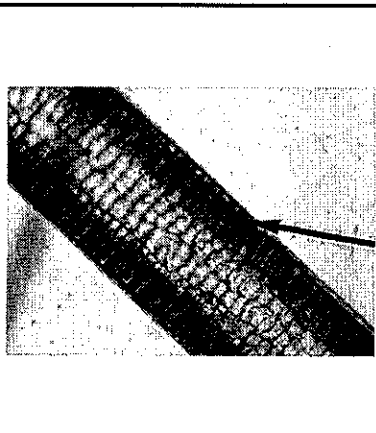


HUMAN CUTICLE SCALES





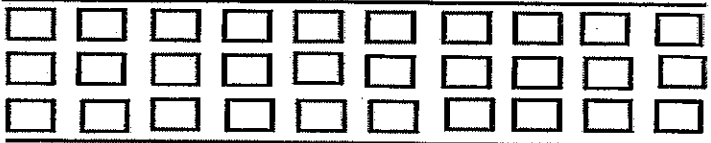




DOG CUTICLE SCALE

HAIR MEDULLA

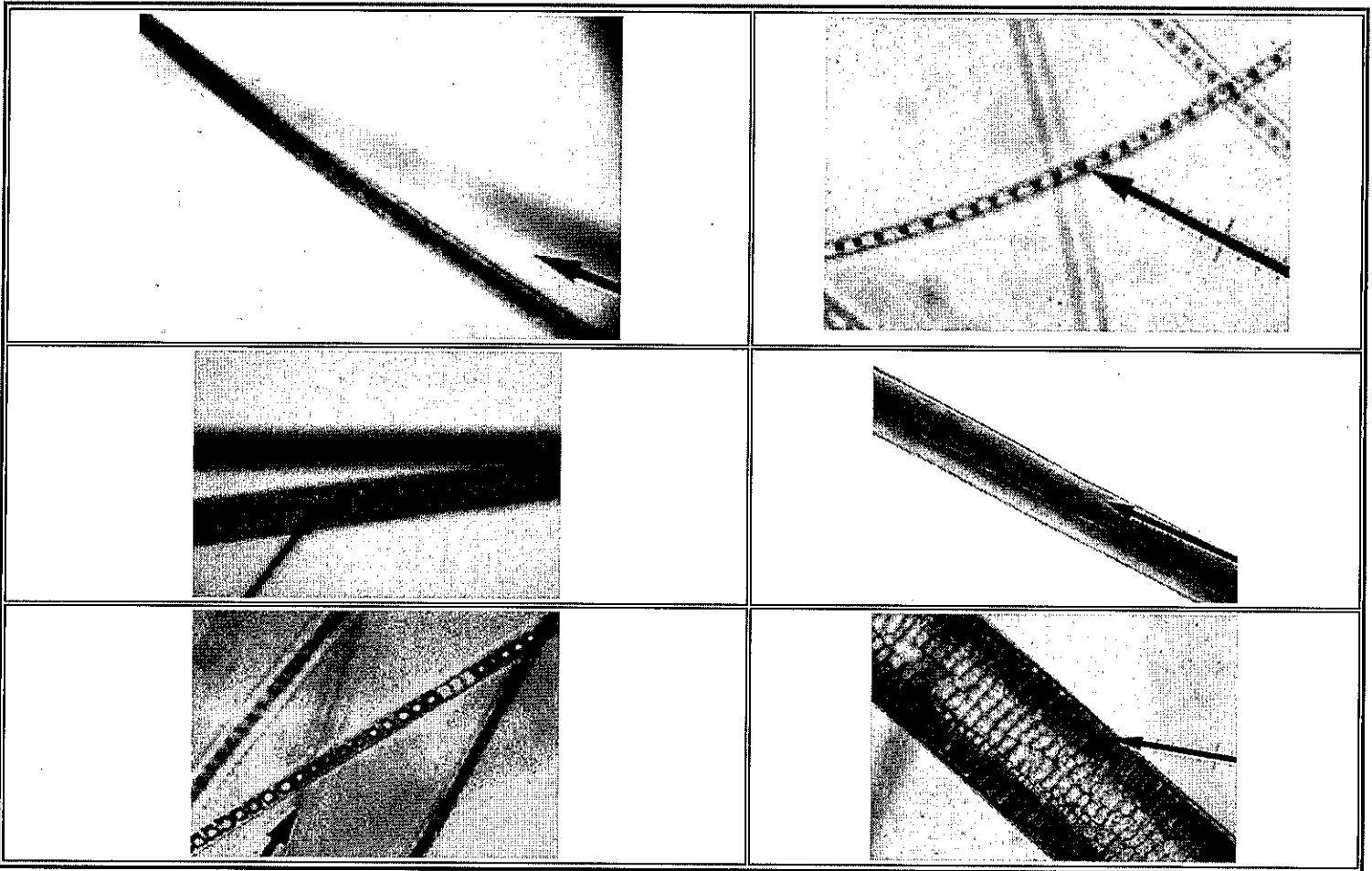
		
CAT	COW	HORSE
		
MUSKRAT	RABBIT	RABBIT

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MEDULLA	The medulla is the core of a hair that is not always present. There are several types and patterns.
TYPES:	
Continuous	
Intermittent or interrupted--even breaks in the medulla	
Fragmented--breaks that are unevenly spaced	
Absent	
PATTERNS:	
Uniserial--small blocks in a row	
Multiserial--several rows of blocks across	
Vacuolated--uneven pattern	
Lattice--circular patterns	
Amorphous--without a specific pattern	

Can you determine source of the different animal medulla?
What is the type and pattern of each of these medulla?

ANSWERS



1.
Medulla Type: _____
Medulla Pattern: _____

4.
Medulla Type: _____
Medulla Pattern: _____

2.
Medulla Type: _____
Medulla Pattern: _____

5.
Medulla Type: _____
Medulla Pattern: _____

3.
Medulla Type: _____
Medulla Pattern: _____

6.
Medulla Type: _____
Medulla Pattern: _____

That's Not My Hair!!!!

Hair Analysis Acceptable Means of Identification

Volume 4, Issue 11 -- Published: Thursday, Oct 12, 2000 -- Last Updated: Monday, Mar 11, 2002

Stanford Johnson was found dead in the home he shared with his son, Terrence Johnson. An autopsy later revealed that the victim was killed by manual strangulation. Because there was no evidence that the victim's home was entered forcibly, Terrence Johnson immediately became a suspect in the investigation of his father's murder.

At trial, witnesses testified that the cuts and bruises the medical examiner observed on Terrence Johnson had not been there the day before the murder. Still other witnesses contradicted Terrence Johnson's statements that he was not home the entire evening before he called the Jefferson County emergency service to report his discovery of his father's body. Perhaps most convincing, however, was the physical evidence: A blood spot found on the victim's clothing matched Terrence Johnson's relatively rare blood type, and hairs found in the victim's hands had the same characteristics as hair samples taken from Terrence Johnson's head. The murder suspect moved to suppress the testimony of the serologist who made the connection between the hair in Stanford Johnson's hands and the hair on Terrence Johnson's head. The trial court overruled that motion.

Frye Yes, Daubert No, Sentenced to a lifetime prison term for his father's strangulation, Terrence Johnson appealed, arguing that, among other things, the court should have suppressed the testimony of the hair analysis expert. Johnson primarily relied on *Williamson v. Reynolds*, 904 F. Supp. 1529 (1995), a case in which a federal district judge in Oklahoma concluded that hair analysis by microscopic comparison, which may have satisfied the test established in *Frye v. United States*, 54 App. D.C. 46 (D.C. Cir. 1923), did not satisfy the test of reliability established in *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 (1993).

The Supreme Court of Kentucky took judicial notice (that is, accepted as true) the state's assertion that hair analysis is scientifically reliable "based upon the overwhelming acceptance of this evidence by other jurisdictions, as well as our own history of routine admission of this evidence at trial." The Court further held that the Appellant could still convince the Court that the trial court erred when it admitted the serologist's testimony, however, by proving that hair analysis is no longer deemed reliable.

The opinion in *Williamson* was virtually the only evidence submitted by Appellant in support of his contention that hair analysis is unreliable. Finding that the case was reversed by its own appellate court and was "thus stripped of any precedential value," the Supreme Court of Kentucky sustained Terrence Johnson's conviction.

What Can Be Learned from Hair

- Human or animal?
- Race.
- Body area of origin.
- Shed or forcibly removed.
- Disease.
- Comparison to known samples.

Exline: Human hair examination and comparisons were first utilized in the early 20th century and remain the foundation of today's hair examiners. In contemporary forensic science, the value of optical hair examinations has been questioned in comparison to methods that utilize high tech instrumentation and newer analytical and statistical methods. However, hair examination is a vital part of any complete forensic laboratory.

Initially, when a sample is recovered from physical evidence or is submitted to the laboratory for examination, it is important to determine whether it is actually a hair. If it is, whether the hair is that of a human or an animal also must be determined. This is easily accomplished by looking at characteristics such as scale patterns, medulla type, color and hair morphology. When the sample has been characterized as human hair, the racial origin and body area are determined. This is an important step because only hairs from the same body region should be compared.

Valuable information can be gained in the characterization step of hair to aid criminal investigations. The racial origin of a hair can direct an investigation whose racial makeup of the assailant is unknown. Other characteristics that can be determined are cosmetic treatments to the hair, naturally shed versus forcibly removed hairs, disease, and other environmental influences.

Can't Beat the Real Thing

A comparison of the questioned hair or hairs is another type of analysis that can be conducted. This is accomplished by comparing the questioned hair(s) to known exemplars submitted for comparison. The comparison is done using a comparison microscope—two optical microscopes connected by an optical bridge. This microscope allows the examiner to compare a questioned and known hair simultaneously in a side-by-side examination. Numerous characteristics such as color, diameter, length, morphology, root morphology, tip morphology, cortical characteristics (e.g., pigment color, pigment size and distribution, medulla type, presence or absence of cortical fusi and their distribution, ovoid bodies and other characteristics in the cortex of the hair), cuticle characteristics (e.g., thickness, size, separation, color and pigment distribution) and other microscopic characteristics of the hair are compared.

Questioned hairs are compared with known hairs from root to tip. If the examiner concludes that all the characteristics in the questioned hair are present in the known standard, corresponding directly to the specific regions of the hair shafts along the entire lengths of the hairs, a positive conclusion can be reached. When a positive hair association is made, a conclusion such as, "the question hair(s) could have originated from the known source," is then stated.

Not All Hair Is the Same

The collection of known standards is an important factor when dealing with hair comparisons. Both plucked and combed hairs should be collected from various regions of the head or pubic regions. This is necessary due to the inherent variations found within a single subject's hair. Known standards from other people who were present at a specific location should be submitted along with the suspect and victim's hairs for elimination purposes (alibi samples). Another factor to consider when dealing with known exemplars is the time of collection. Hairs may change over time. As hairs grow and naturally shed, the characteristics of the hair may change over a period of time, depending on the specific body origin and environmental influences.

The value of a hair comparison is dependent on the education, experience and training of the examiner performing the analysis. It is this experience that allows the examiner to understand the various factors that add or detract from the significance of a hair comparison.

Airline luggage handler jailed for stealing women's hair

POSTED: 12:34 a.m. EST, March 2, 2007

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SYDNEY, Australia (Reuters) -- An Australian man who worked as a baggage handler for the national airline Qantas was jailed for at least two years on Friday for stealing hair from women's luggage to satisfy a sexual fetish.

Rodney Lyle Petersen, 30, pleaded guilty in the Victorian County Court to 50 counts of theft, Australian Associated Press reported.

The court was told that Petersen would rummage through lost or delayed luggage that he was returning to passengers. He collected the hair from brushes and clothing, then put it inside plastic slips and recorded the women's personal details.

Police said he had catalogued the hair in more than 80 bags.

Petersen's lawyer told the court that his client did not mean to frighten the women because they were not meant to find out.

The court was told that Petersen suffered from a range of sexual deviances.

He was sentenced to two years and eight months in jail, with a non-parole period of two years.

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