



DAY 1: FINGERPRINTS,

SHOE PRINTS,

HAIR/FIBERS

PRINCIPLES OF FINGERPRINTS

- A fingerprint is an **individual** characteristic; no two people have been found with the **exact** same fingerprint pattern.
- A fingerprint **pattern** will remain **unchanged** for the **life** of an individual; however, the print itself may change due to permanent scars and skin diseases.
- Fingerprints have general characteristic **ridge** patterns that allow them to be systematically identified.



FINGERPRINTS CLASSES

There are 3 specific classes for all fingerprints based upon their visual pattern:

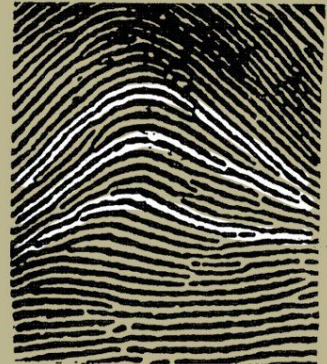
- **Arch**
 - Plain arch
 - Tented arch
- **Loop**
 - Radial Loop
 - Ulnar loop
- **Whorl**
 - Plain whorl
 - Central pocket whorl
 - Double loop whorl
 - Accidental



Loop



Whorl

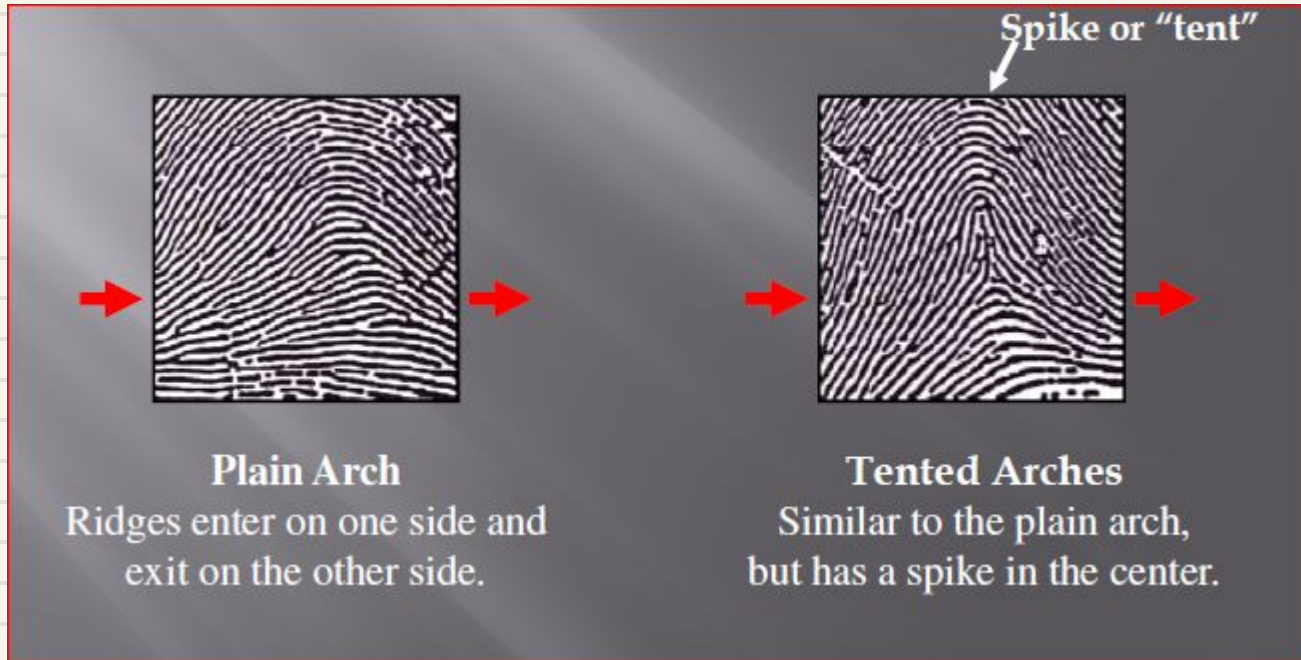


Arch



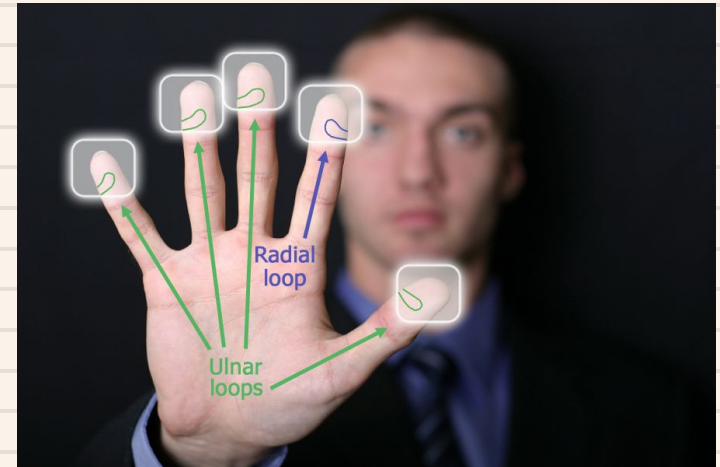
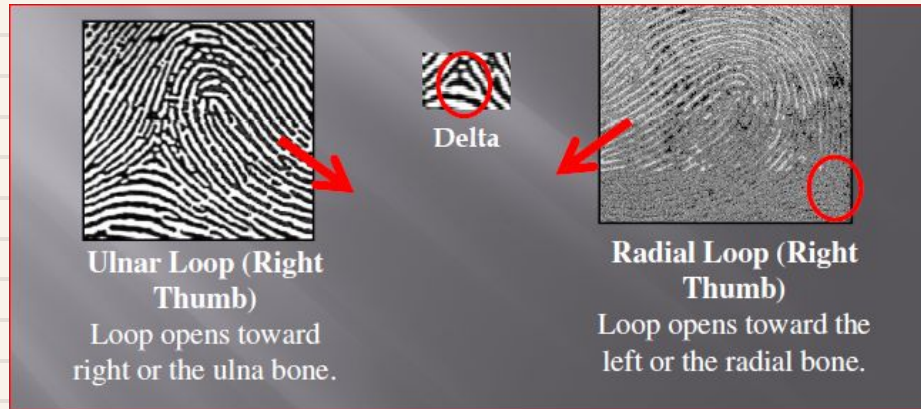
FINGERPRINTS – ARCHES

- Arches are the simplest type of fingerprints that are formed by ridges that enter on one side of the print and exit on the other. No deltas are present.



FINGERPRINTS – LOOPS

Loops must have one delta and one or more ridges that enter and leave on the same side. These patterns are named for their positions related to the radial and ulnar bones.

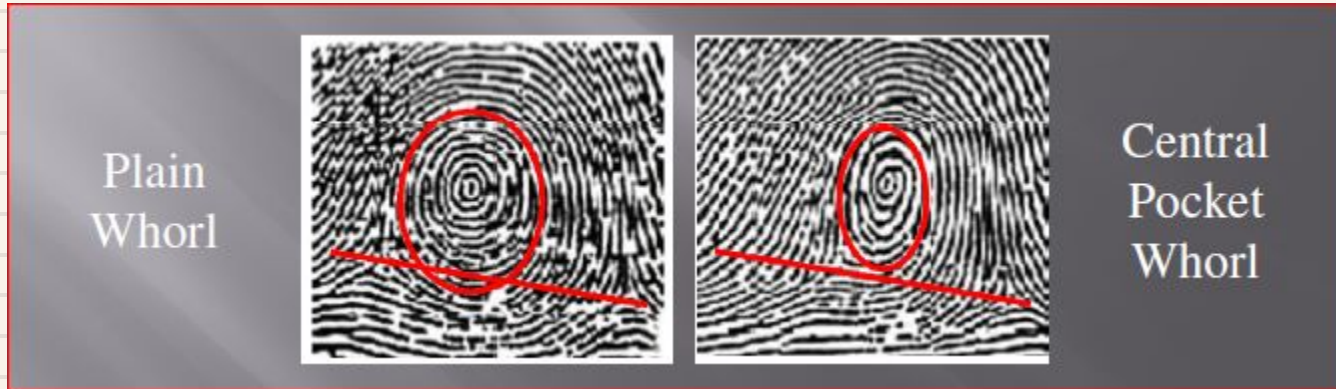


NOTE: On the left hand, a loop that opens to the left would be an ulnar loop, while one that opens to the right would be a radial loop.



FINGERPRINTS – WHORLS

Whorls have at least one ridge that makes (or tends to make) a complete circuit. They also have at least two deltas. If a print has more than two deltas, it is most likely an accidental.

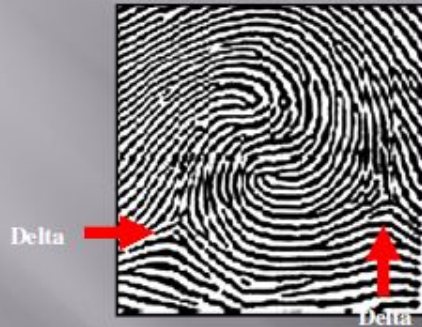


Draw a line between the two deltas in the plain and central pocket whorls. If some of the curved ridges touch the line, it is a plain whorl. If none of the center core touches the line, it is a central pocket whorl



FINGERPRINTS – WHORLS

Double Loop Whorl



Double loop whorls are made up of any two loops combined into one print.

Accidental Whorl



Accidental whorls contain two or more patterns (not including the plain arch), or does not clearly fall under any of the other categories.



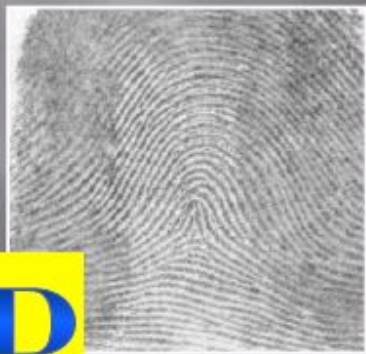
**CAN YOU
IDENTIFY
THE
PATTERN**



Left Hand



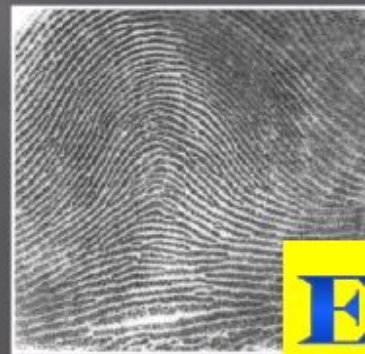
Right Hand



Right Hand



Right Hand



Left Hand

FINGERPRINTS TYPES

- **Latent fingerprints** are made of the sweat and oil on the skin's surface.
 - Invisible to the naked eye and requires additional processing in order to be seen
 - Processing can include basic powder techniques or the use of chemicals
- **Patent fingerprints** can be made by blood, grease, ink, or dirt.
 - This type of fingerprint is easily visible to the human eye.
- **Plastic fingerprints** are three-dimensional impressions and can be made by pressing your fingers in fresh paint, wax, soap, or tar.
 - Plastic fingerprints are easily seen by the human eye and do not require additional processing for visibility purposes.



WHAT IS IMPRESSION EVIDENCE?

- Impression evidence can be defined as: Objects or materials that have **retained the characteristics of other objects** through **direct contact**.
- Impressions are created when one object is **pressed** against another material with enough force to **leave an impression** of the object.
- Examples: shoe prints, tool marks, tire tracks, bite marks, marks on a fired bullet
- Impressions may be found in or on many different types of materials. The quality of the impression depends on the object making the impression and the surface conditions, such as how hard or soft it is and what type of material it is (soil, mud, dust, concrete, grass, skin, etc.)



SHOE PRINT EVIDENCE

- Investigators can analyze a shoe print to determine its **class**, or the **type** and **brand** of shoe. They will also look for individual characteristics, such as wear patterns and specific damages or defects.
- Databases of shoe prints are available for investigators to help them determine the brand of shoe to provide leads for a case.
- Depending on the quality of the impression, investigators may be able to determine a **person's speed** (walking vs. running) as well as estimate the size of a person based on the impression depth.
- Features to analyze:
 - Tread patterns, size, and depth
 - Wear patterns caused by the way a person walks
- Material defects or damage (nicks, cuts, etc.)
- Other trace materials, such as soil, tar, rocks, and paint that would indicate where a person has been



BREAK! 20 MIN



ACTIVITY

- Now that you have learned about how fingerprints can be used in forensic science, let's see how this works in real life!

Instructions

1. Get a dark marker and color each one of your fingers
2. While the ink is still wet, quickly stamp your fingers onto the handout provided
 - a. Match up each finger with the corresponding slot
3. Identify your finger type!
4. Compare with your friends!



ACTIVITY

- Let's also see how we can use footprints to identify criminals in forensic science! We'll be using some examples from real life to see how scientists are able to pinpoint suspects

Instructions

1. Place a blank sheet of white paper on the ground
2. Take one foot and step on the paper really hard, making sure to leave an imprint
3. Pick up the paper and see what the imprint looks like
4. Swap papers randomly with a friend, and see if they would be able to identify you by foot!



HAIR STRUCTURE

Hair is composed of three principal parts:

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.

HAIR AS EVIDENCE

- The following information can be learned by examining pieces of hair:
 - Source (human or animal): does the suspect have a pet?
 - Races (sometimes): ovoid bodies
 - Location on source's body: from head, leg arm, etc
 - Forcibly removed?
 - Chemical treatments: bleach, hair dye, etc.
 - If drugs have been ingested (not as popular as urine drug test)



FIBERS

A **fiber** is the smallest unit of a textile material that has a **length** many times greater than its **diameter**. A fiber can be spun with other fibers to form a **yarn** that can be woven or knitted to form a fabric.

The **type** and length of fiber used, the type of **spinning** method, and the type of **fabric** construction all affect the transfer of fibers and the significance of fiber associations. This becomes very important when there is a possibility of fiber **transfer** between a suspect and a victim during the commission of a crime.

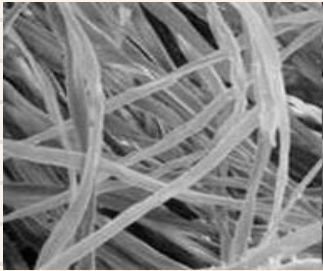
Matching **unique** fibers on the clothing of a victim to fibers on a suspect's clothing can be very helpful to an investigation, whereas the matching of **common** fibers such as white cotton or blue denim fibers would be less helpful.

The discovery of **cross transfers** and multiple fiber transfers between the suspect's clothing and the victim's clothing dramatically **increases** the likelihood that these two individuals had physical contact.



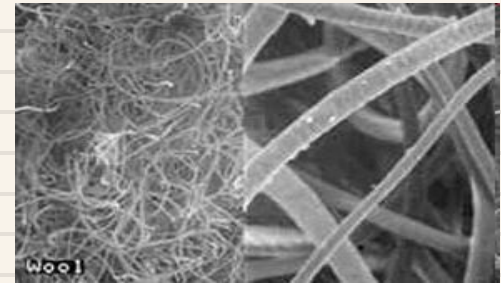
FIBERS

Many different **natural** fibers that come from plants and animals are used in the production of fabric.



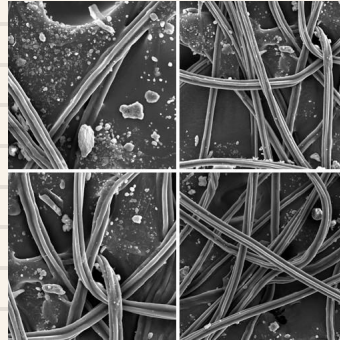
Cotton fibers are the plant fibers most commonly used in textile materials

The animal fiber most frequently used in the production of textile materials is **wool**, and the most common wool fibers originate from sheep.



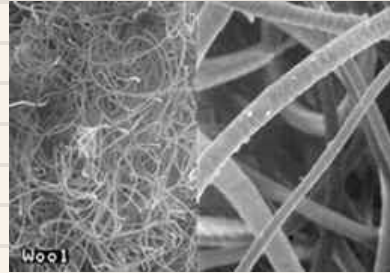
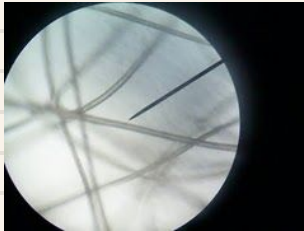
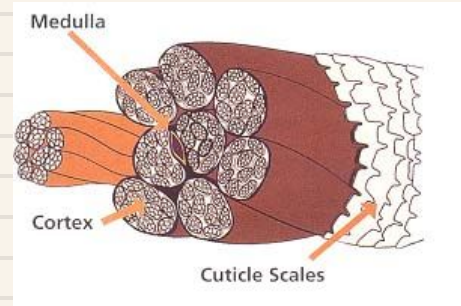
PLANT FIBER CHARACTERISTICS

- Plant fibers come from plants, such as hemp, flax, bamboo and cotton.
- Modern paper comes from wood pulp
- Will not dissolve in bleach



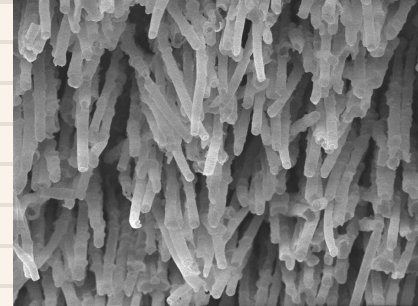
ANIMAL FIBER CHARACTERISTICS

- Animal fibers are human hair, silk and animal fur, such as wool
- Have structures
 - Medulla
 - Cortex
 - Cuticle
 - DNA



SYNTHETIC FIBERS

- Made from man-made or natural materials
- Some examples: Nylon, Lycra, spandex, polyester, fiberglass, carbon fibers
- Often in clothing or carpets

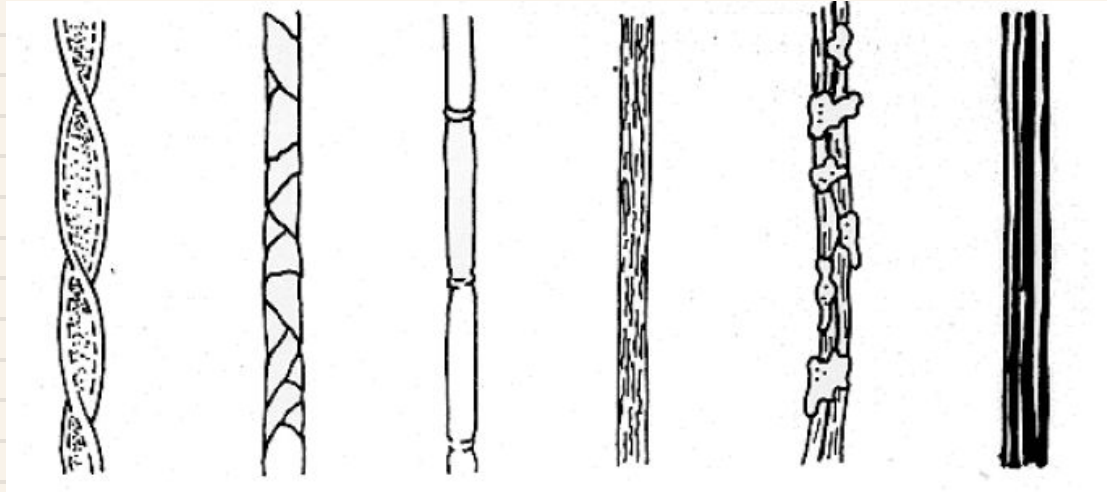


FIBER CHARACTERISTICS

- Fibers are either Animal, Vegetable or Synthetic (man-made)
- Identify using magnifying glass or microscope
- Further testing with **Burn Test**
 - Synthetic fibers will melt much faster than animal or vegetable fibers
 - Hair and wool have a strong smell when burned
- Animal fibers dissolve in bleach
- Real-world testing is more sophisticated – clothing is often a mixture of man-made and natural fibers.



SHAPES OF FIBERS



Cotton Wool Linen Nylon Silk Rayon



FINAL ACTIVITY

You have been recruited by the San Diego Police Department to solve a mystery!

Yesterday, on a dark and stormy night in San Diego, 23-year old Mr. Jones was mysteriously found dead in his apartment! Reported to have been living alone at the time of the incident, there were no witnesses of the murder, leaving the police stumped. Luckily for you, although there were no witnesses, the chief of police has narrowed the case down to three major suspects for you to choose from! There are many hidden clues around the room for you to help the police identify the murderer!

It's up to you to solve Mr. Jones' murder! Can you apply what you learned to bring the case to a close?

Hint: look for fingerprints, hair, and footprints



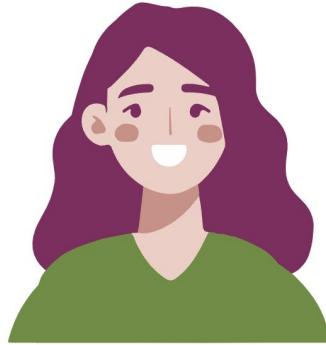
The Suspects:



Mrs. Lee
Hair: Purple, curly
Fingerprint type: loop
Shoe:



The Suspects:



Ms. Whitney
Hair: Magenta, curly
Fingerprint type: loop
Shoe:



The Suspects:



Mr. Evans
Hair: Teal, straight
Fingerprint type: whorl
Shoe:



THANK YOU!

