

Unit 3

Fingerprints














History of Fingerprinting

- First known use: nearly 4000 years ago as signatures on clay tablets - China
- In western culture, earliest record of studying patterns on human hands is 1684.



History of Fingerprinting

- In 1896, Sir Edmund Richard Henry created a system of classifying prints as loops, whorls, or arches. This led to keeping record on the ten card, allowing them to be used in criminal investigations from then on.

CHECKED 24 HR. SHEET		340		LEAVE THIS SPACE BLANK		
Name MALCOLM LITTLE		Classification 92Aa 10				
Alias _____		Ref. 1aB				
No. _____		Color BLACK Sex MALE				
1.—Right Thumb	2.—R. Index Finger	3.—R. Middle Finger	4.—R. Ring Finger	5.—R. Little Finger		
						
6.—Left Thumb	7.—L. Index Finger	8.—L. Middle Finger	9.—L. Ring Finger	10.—L. Little Finger		
						
Four fingers taken simultaneously		Amputation			Four fingers taken simultaneously	
Left hand		Left Thumb Right Thumb		Right hand		
						
Impressions taken by P. J. Smith 10/1/1898		Prisoner's signature Malcolm Little				
Classified by _____						
Verified by _____						

History of Fingerprinting

- Fingerprints are now taken digitally for clearer reference and stored in IAFIS.
- As of 2013 FBI is integrating palm prints as well.

Fundamentals of Fingerprints

Three fundamental principles that fingerprints follow:

- 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.

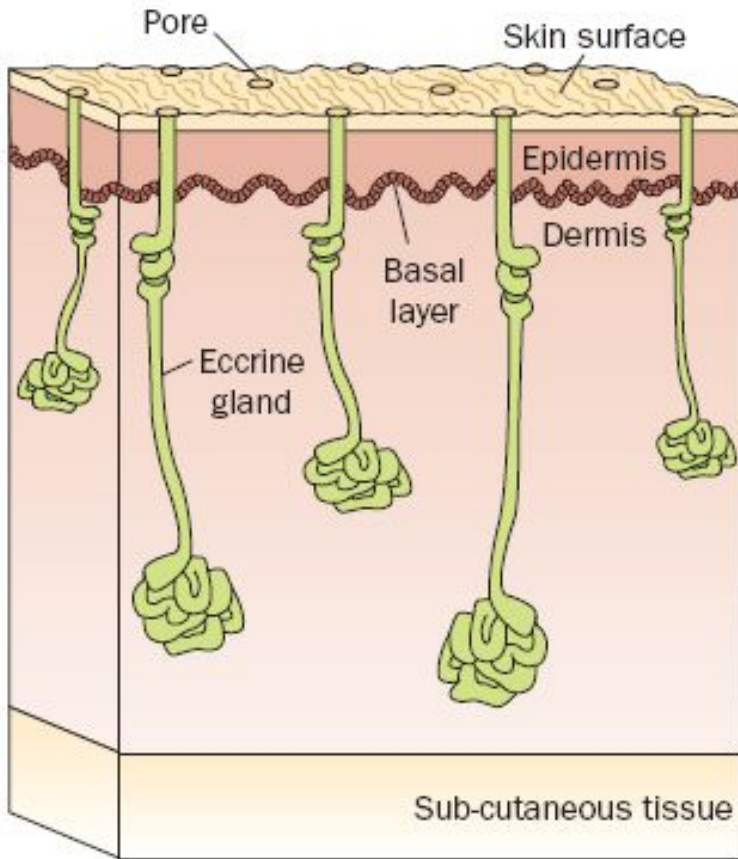
What is a fingerprint?

- The inner layer of skin creates ridges while still in the mother's womb.
- Prints remain the same throughout lifetime, unless damaged by scarring.
- Ridges connect to other ridges forming a unique print.



Formation of Fingerprints

- Our skin has ridges on the surface to help us grip things.



The epidermis is the outer layer of the skin, while the dermis is the inner layer of the skin.

The dermal papillae is a layer of cells between the epidermis and dermis, that is responsible for determining the form and pattern of the ridges on the surface of the skin.

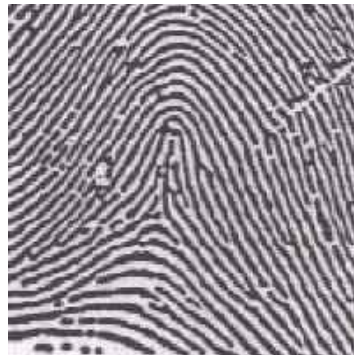
Can Fingerprints Be Changed?

- Many criminals have tried, using chemicals or fire.
- Most end up with even more recognizable prints because of differences in the scarring patterns.



Classes of Fingerprints

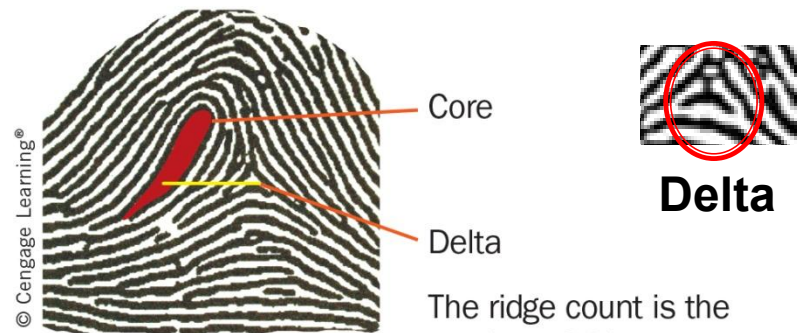
- All fingerprints are divided into three classes on the basis of their general pattern: *loops*, *arches*, and *whorls*.
Each class is divided into smaller categories.



Characteristics of Fingerprints

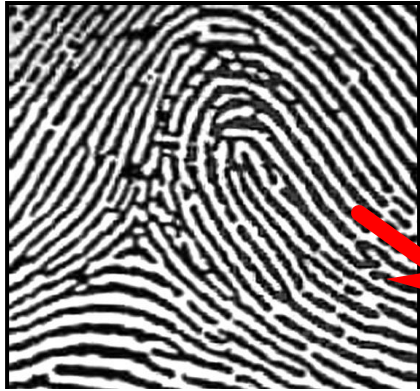
- Three main types:
 - Loop - most common, about 65% of all prints
 - Loops must have one delta and one or more ridges that enter and leave on the same side. These patterns are named for their positions related to the radius and ulna bones.

Figure 6-6 *The red patch is called the core, and it is located at the center of a loop or whorl.*



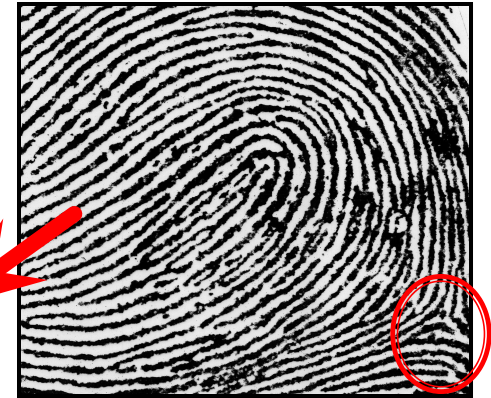
The ridge count is the number of ridges between the core and the center of the delta.

Characteristics of Fingerprints



**Ulnar Loop
(Right Thumb)**
Loop opens toward
right or the ulna bone.

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.

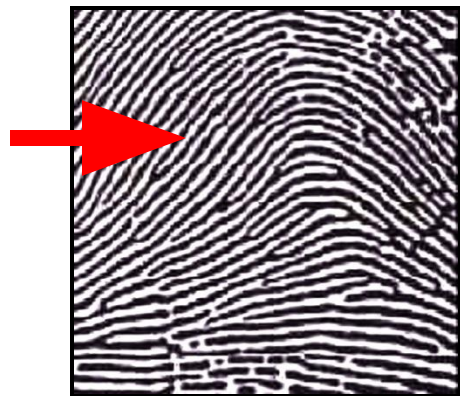


**Radial Loop
(Right Thumb)**
Loop opens toward the
left or the radial bone.

Characteristics of Fingerprints

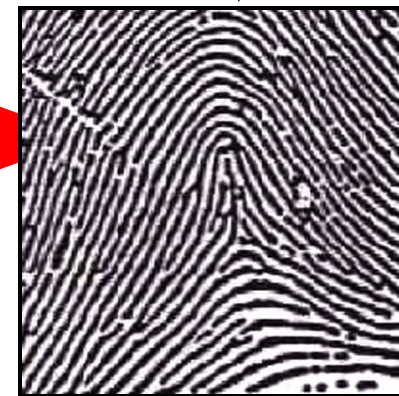
- Arches – About 5% of all fingerprints.

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.



Plain Arch

Ridges enter on one side and exit on the other side.



Tented Arches

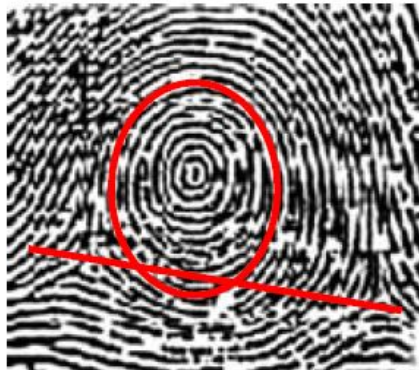
Similar to the plain arch, but has a spike in the center.

Characteristics of Fingerprints

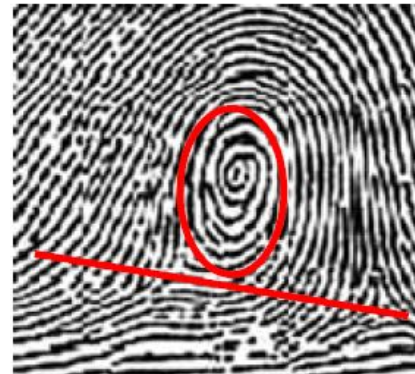
- Whorls – About 30% of all prints

Whorls have at least one ridge that makes (or tends to make) a complete circuit. They also have at least two deltas.

Plain
Whorl



Central
Pocket
Whorl



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.

Whorls – Part 2

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.

Identify These!

- Show of fingers: Identify these:



Whorl



Arch



L hand

Loop (radial)

Identify These!



R hand

Loop (ulnar)



R hand

Loop (radial)



Whorl

Identify These!



**Double Loop
Whorl**



**L hand
Loop (ulnar)**



Whorl

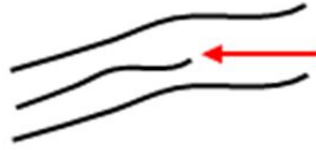
- Mathematically, the probability for the existence of two identical fingerprint patterns in the world's population is extremely small.
- Besides theoretical calculations, of the millions upon millions of individuals who have had their prints classified, no two fingerprints have been found to be identical.
- The individuality of a fingerprint is not determined by its general shape or pattern, but by the careful study of its ridge characteristics, known as minutiae.

- It is the identity, number, and relative location of these minutiae that imparts individuality to a fingerprint.
- There are as many as 150 minutiae on the average finger.
- In a judicial proceeding, an expert must demonstrate a point-by-point comparison in order to prove the identity of an individual.

Ridge Characteristics/ Minutiae



Core



Ending Ridge



Short Ridge



Fork or
Bifurcation



Delta



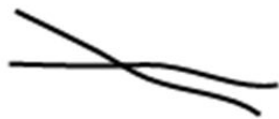
Hook



Eye



Dot or Island



Crossover



Bridge



Enclosures



Specialty



Evidence Types



■ Three types of prints can be found:

- **Patent fingerprints** –visible prints left when fingers have a liquid (such as blood) on them.
- **Plastic fingerprints** –are visible, impressed prints that occur when a finger touches a soft, malleable surface resulting in an indentation.
 - Surfaces that may contain this type of fingerprint are those that are freshly painted or coated, or those that contain wax, gum, or any other substance that will soften when hand held and then retain the finger ridge impressions. These prints require no enhancement in order to be viewed, because they are impressed onto an object and are easily observable.



Evidence Types

- **Latent fingerprints** – hidden prints that can be made visible with special techniques.



- **All fingerprints are individual evidence.**

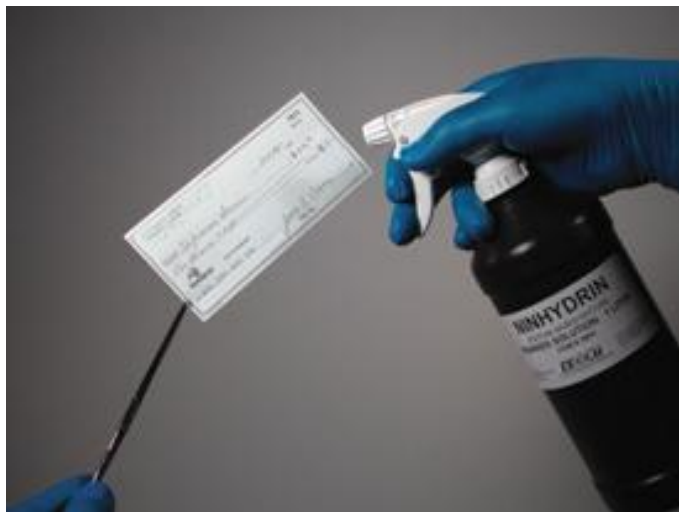
Methods to Collect Fingerprints

- Latent prints can be made visible with carbon or talc, and then collected on tape.



Methods to Collect Fingerprints

- Ninhydrin can be sprayed on paper. It reacts with amino acids in sweat to leave a purple print.



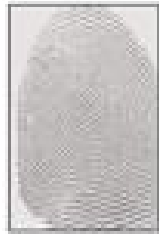
Methods to Collect Fingerprints

- Cyanoacrylate (super glue) can be heated in a vapor tent. It sticks to amino acids to get fingerprints on glass, plastic, metal, and skin.



Methods to Collect Fingerprints

- Wood or Styrofoam objects can be dipped or sprayed with silver nitrate. It reacts with chloride in the salty sweat to show a print.



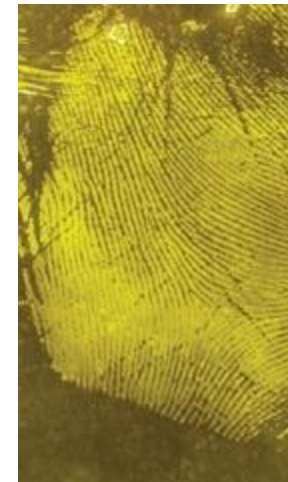
Methods to Collect Fingerprints

- Iodine can be heated in a vapor tent or a fuming gun to get prints off of paper, cardboard, and unpainted surfaces. It fades and must be photographed.



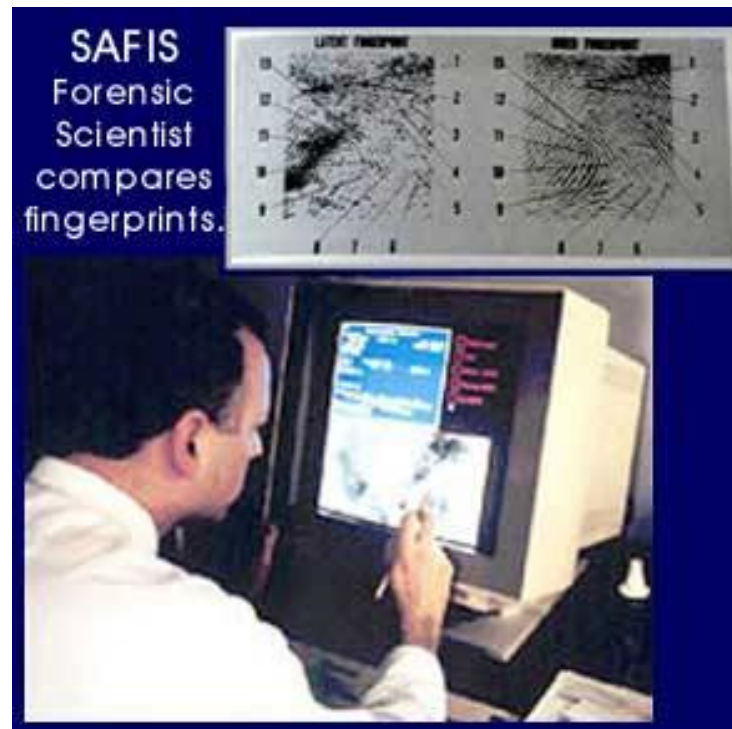
Methods to Collect Fingerprints

- Fluorochromes can be sprayed on non-porous items and then viewed with UV light.



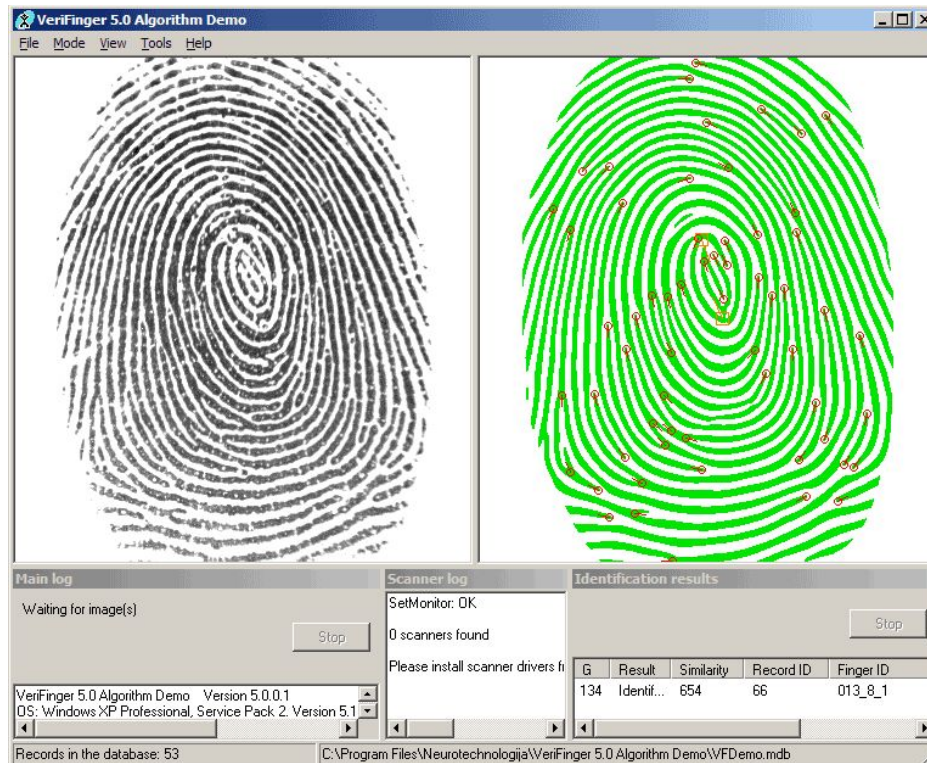
How Are Fingerprints Analyzed?

- IAFIS (*Integrated Automated Fingerprint Identification System*) has more than 76 million prints on file.
 - Also includes mug shots, scars, tattoo photos, and other identifiers
- Digital searches take about two hours, and provide a list of “**possibles**” which are then compared by technicians.
- No international standard for number of minutiae to make a match. In Australia twelve points must match.



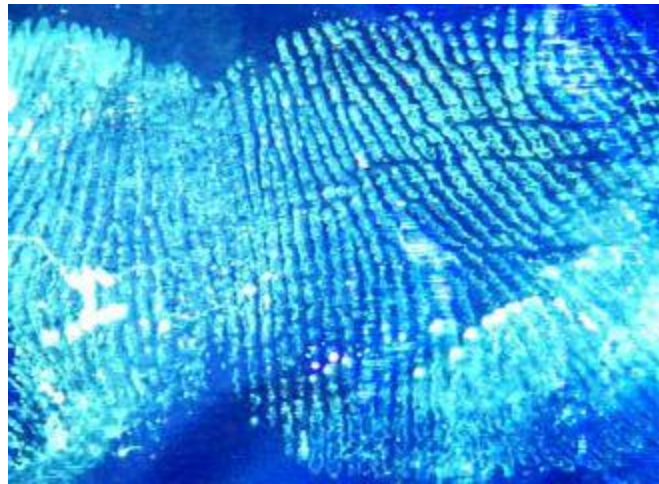
The Future of Fingerprint Technology

- Scanning technology can show tiny pore patterns on ridges for better matching.



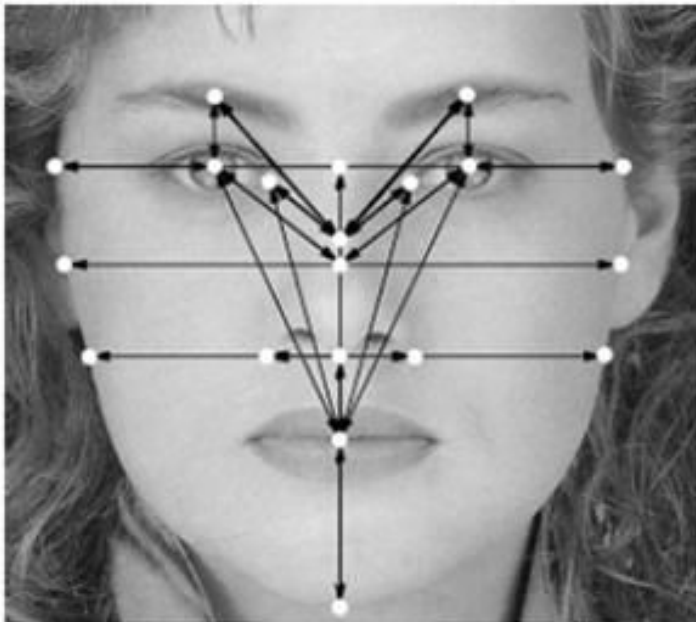
The Future of Fingerprint Technology

- Trace evidence in fingerprints is being used to identify traces of explosives or drugs.



The Future of Fingerprint Technology

- Other physical features such as eye and facial patterns are being used to identify people.





Try It!

- 1 – Blow up your balloon about halfway and twist the end to keep the air from coming out. Do not tie it off!
- 2 – Use an ink pad to make a print with all of your fingers and label each one with a permanent marker. Write your name on the balloon as well.
- 3 – Blow up the balloon to full size and tie the end.
- 4 – Analyze the fingerprints to find several ridge structures that we have discussed. Use a highlighter to mark these structures on your “My Prints” worksheet.

Think About It!

Which ridge structures were most common in your fingerprints?

Which ridge structures were most common in your group?

Were there any structures that were not found in any of the fingerprints?