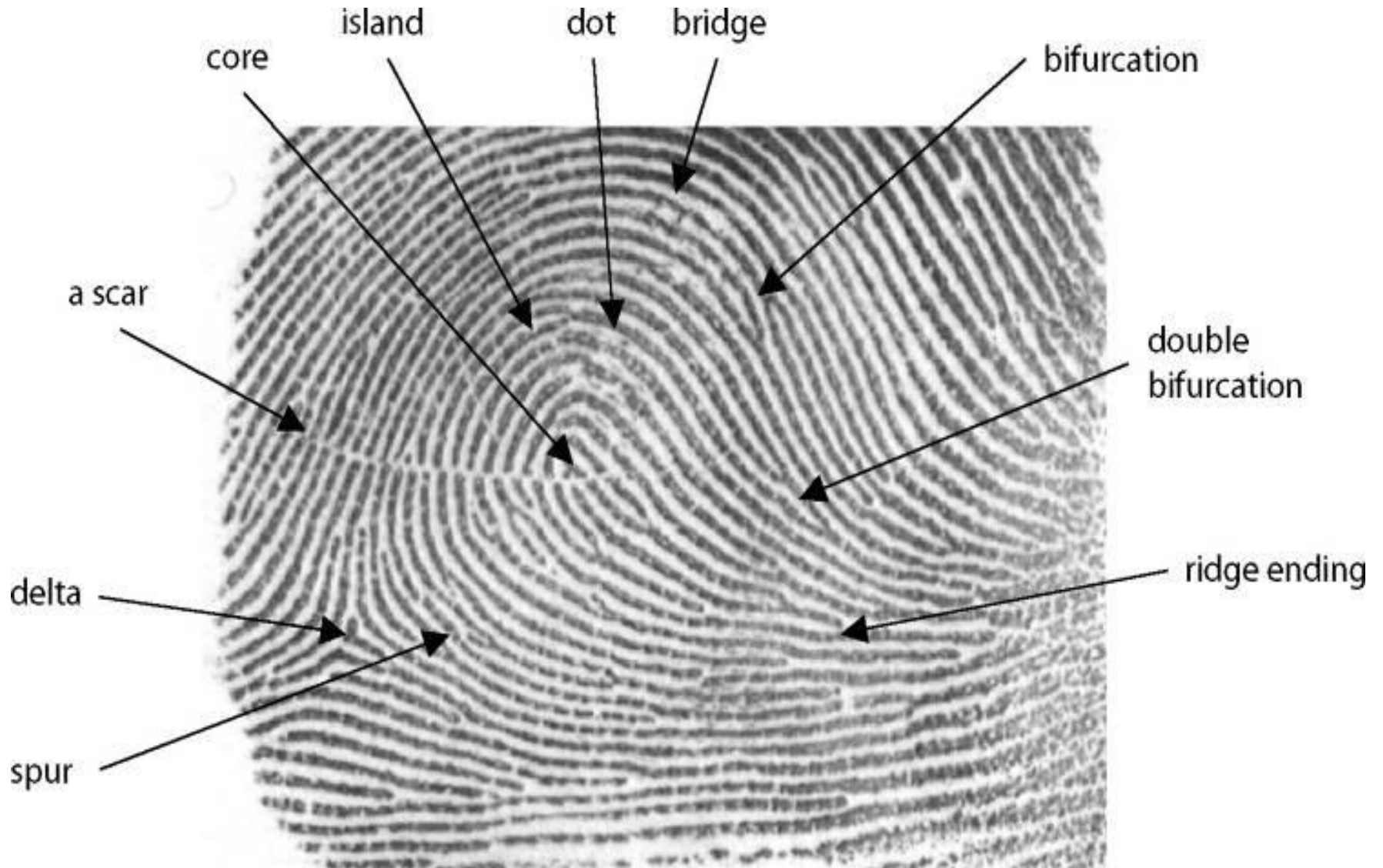


Fingerprint Minutiae

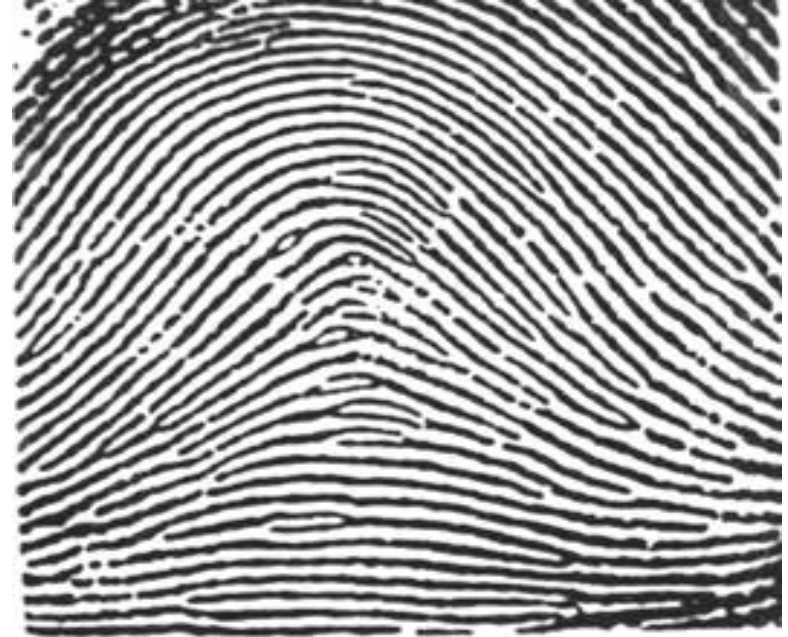


Arch

1. An arch has friction ridges that enter on one side of the finger and cross to the other side while rising upward in the middle. They do NOT have type lines, deltas, or cores.

2. *Types*

- Plain
- Tented



Loop

1. A loop must have one or more ridges entering and exiting from the same side. Loops must have one delta.

2. *Types*

- **Radial**—opens toward the thumb
- **Ulnar**—opens toward the “pinky” (little finger)

3. Which type of loop is this, if it is on the right hand? Left hand?



Whorl

1. A plain or central pocket whorl has at least one ridge that makes a complete circuit.
2. A double loop is made of two loops. An accidental is a pattern not covered by other categories.
3. Whorls have at least two deltas and a core.

4. *Types*

- Plain
- Central pocket
- Double loop
- Accidental



Loop



Whorl

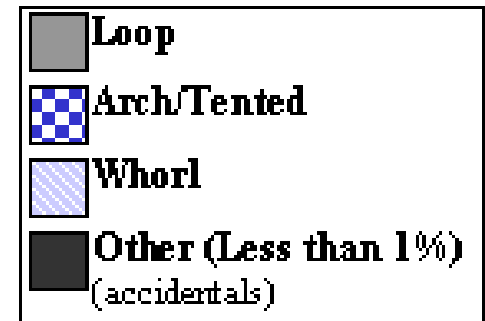
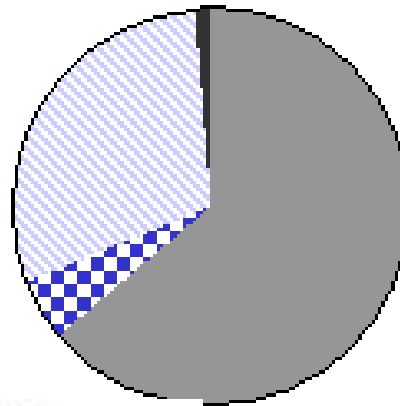


Arch



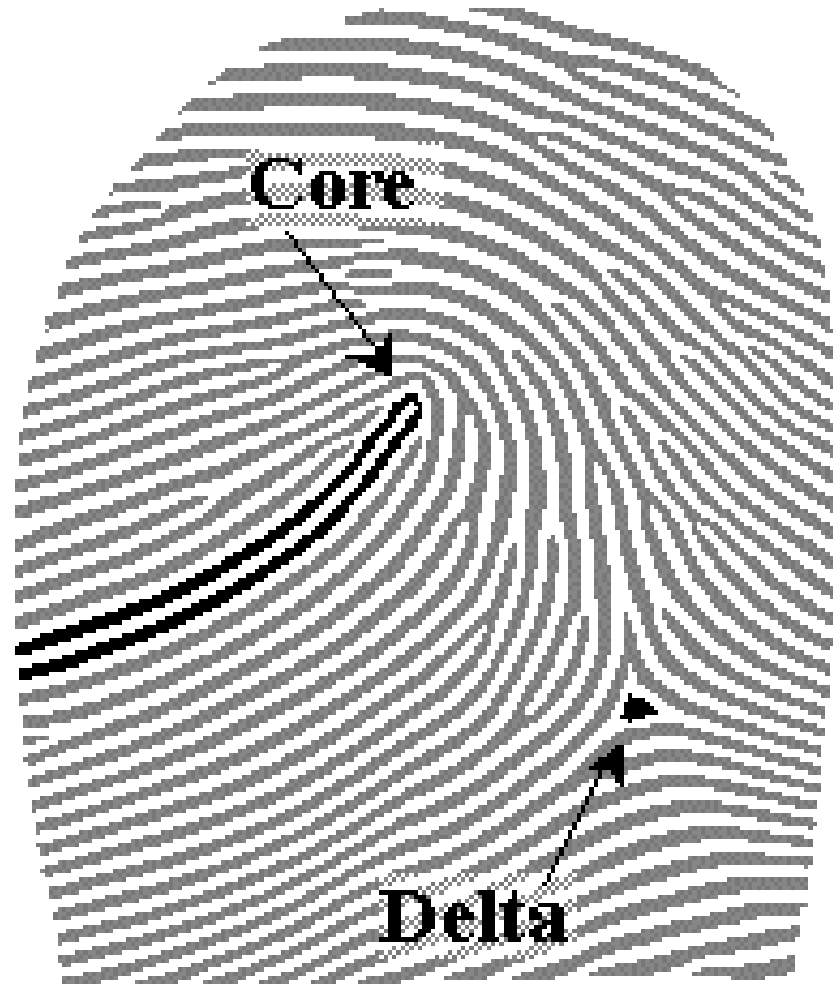
Percentages in the Population

- Loop – 65%
- Whorls – 30%-35%
- Arches – 5%



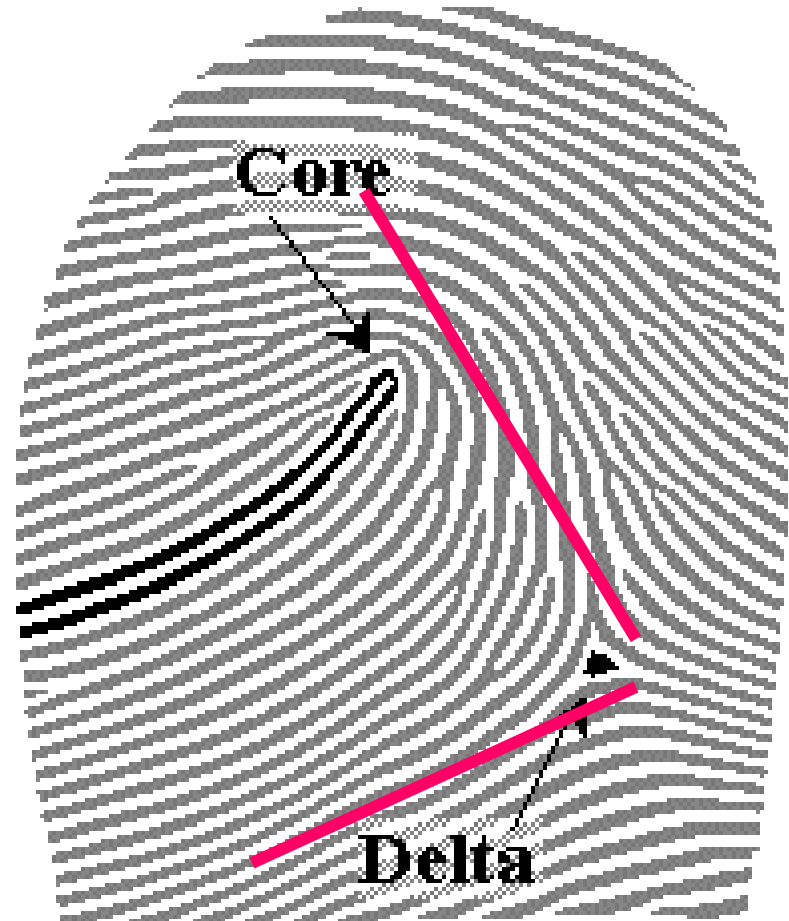
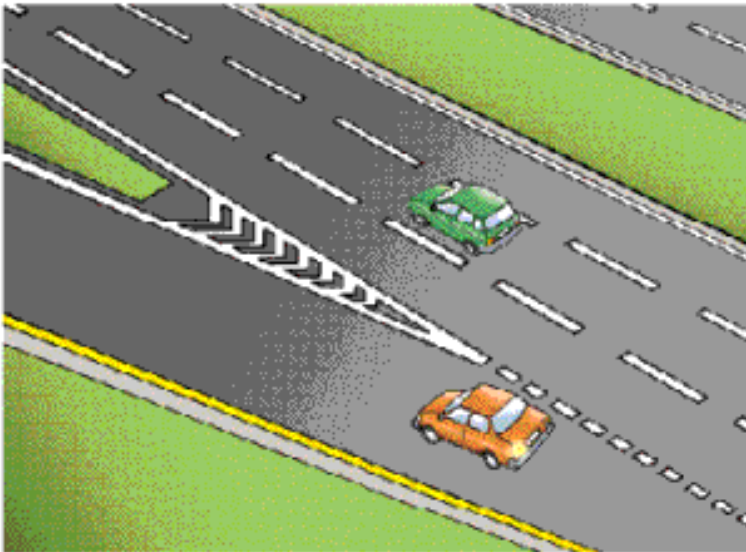
Core

1. Top of the innermost recurving ridge
2. Center of the pattern



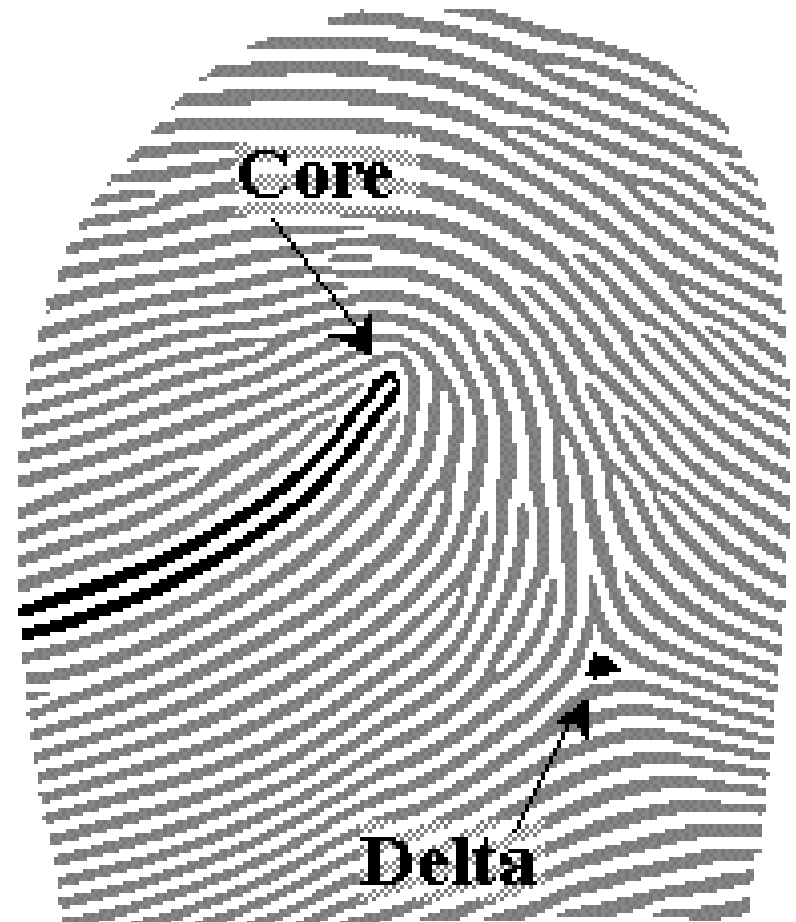
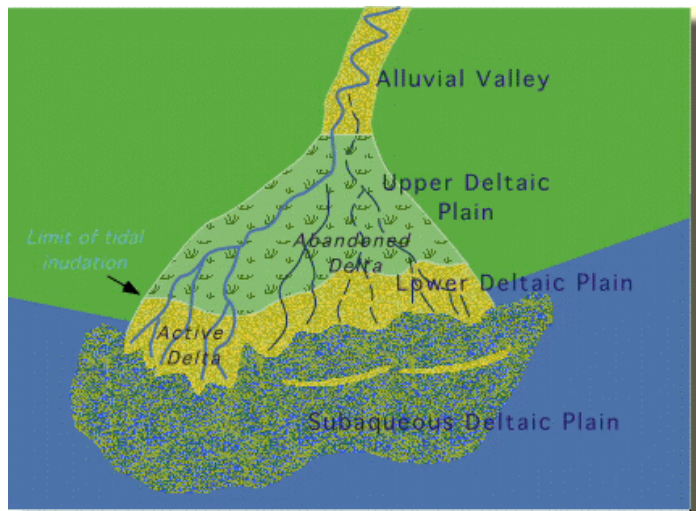
Type Lines

- Diverging ridges that go above & below the loop



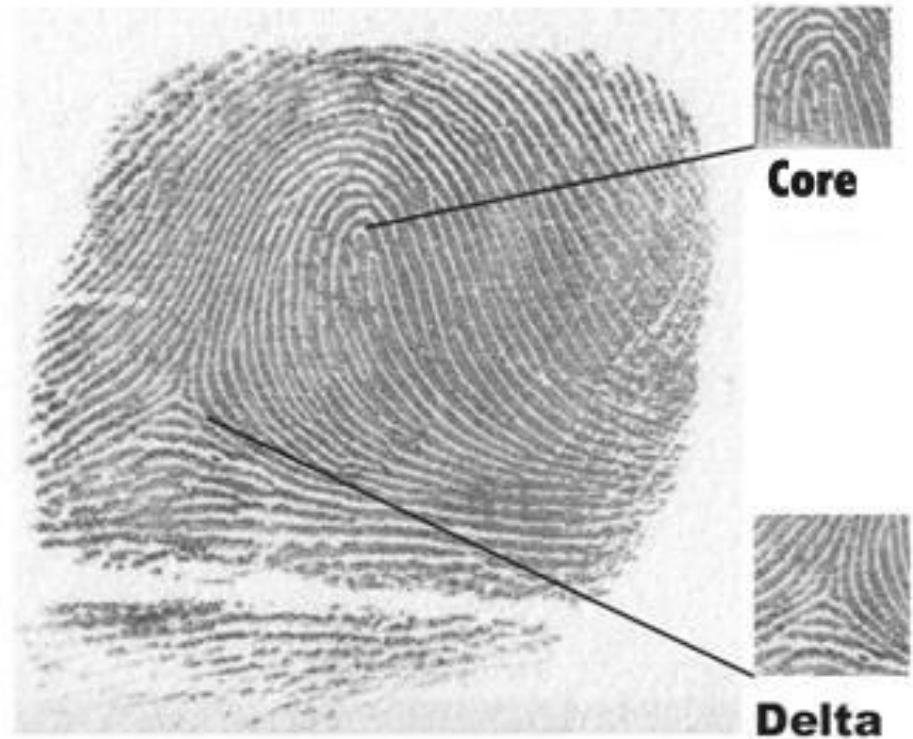
Delta

- The point of divergence of the type lines



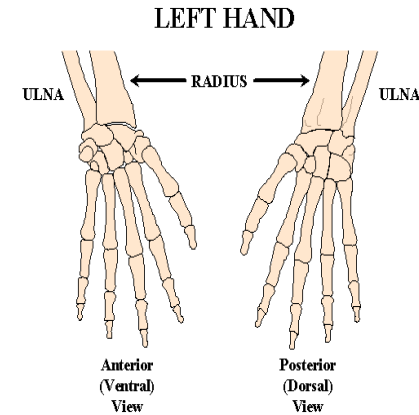
Loop Pattern

1. One or more ridges entering and exiting from the same side it began.
2. Must have one delta.



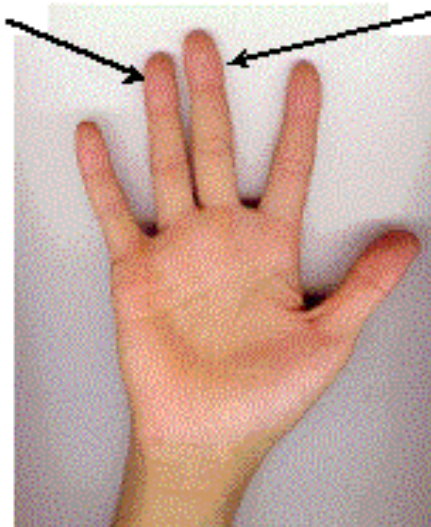
Types of Loops

1. Radial--opens towards thumb
2. Ulnar--opens towards pinky



Ulnar Loop (U)

Ulnar loops have at least one ridge that starts on the little finger side, extends across the finger and curves back to the little finger side.



Radial Loop (R)

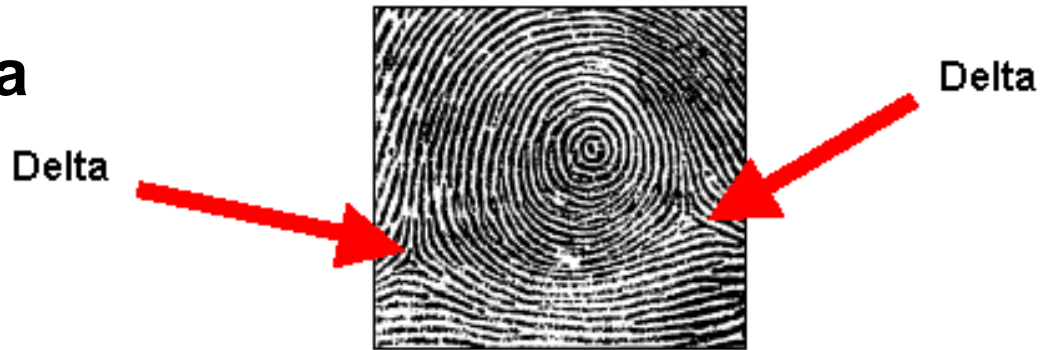
Radial loops have at least one ridge that starts on the thumb side, extends across the finger and curves back to the thumb side.

Whorl

1. Have type lines and a minimum of 2 deltas

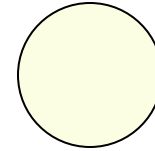
2. Types

- Plain
- Central Pocket
- Double Loop
- Accidental

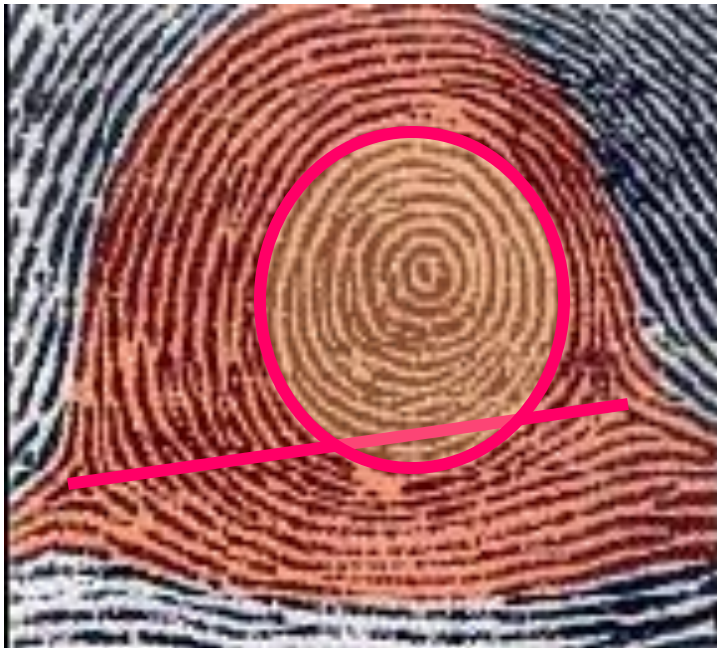


Plain & Central Pocket loop

- Both have at least one ridge that makes a complete circuit (spiral).



PLAIN - Line drawn between the two deltas touches a spiral ridge



CENTRAL POCKET LOOP - Line drawn between the two deltas doesn't touch a spiral ridge



Double loop

1. Two loops combined
2. s-shaped



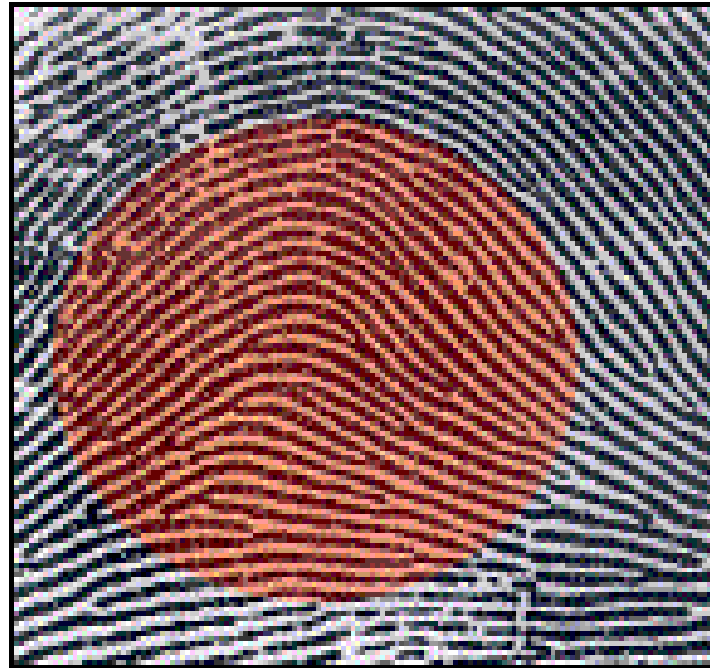
Accidental

- Has 2 or more patterns (not including the plain arch)



Arches

1. Ridges enter on one side and cross to the other side while rising upward in the middle.
2. No type lines, deltas, or cores.

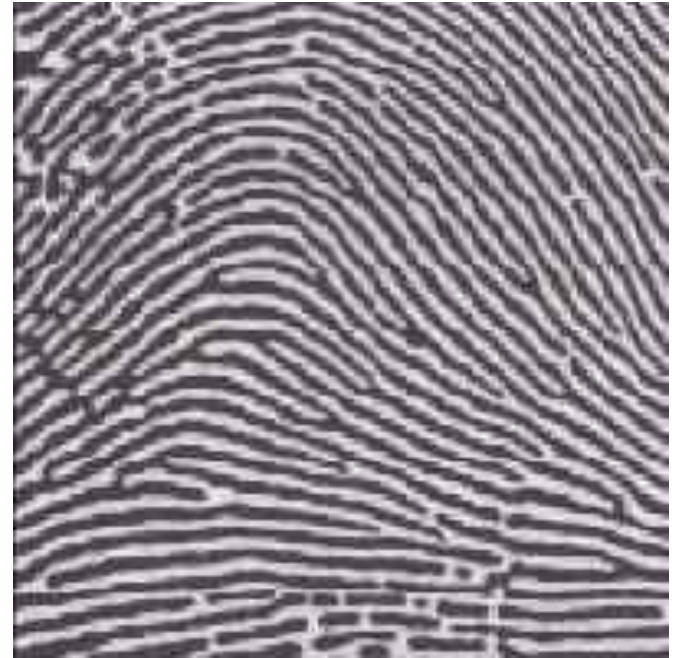


Types

**Tented sharp
center rise**



Plain



What is the fingerprint pattern?



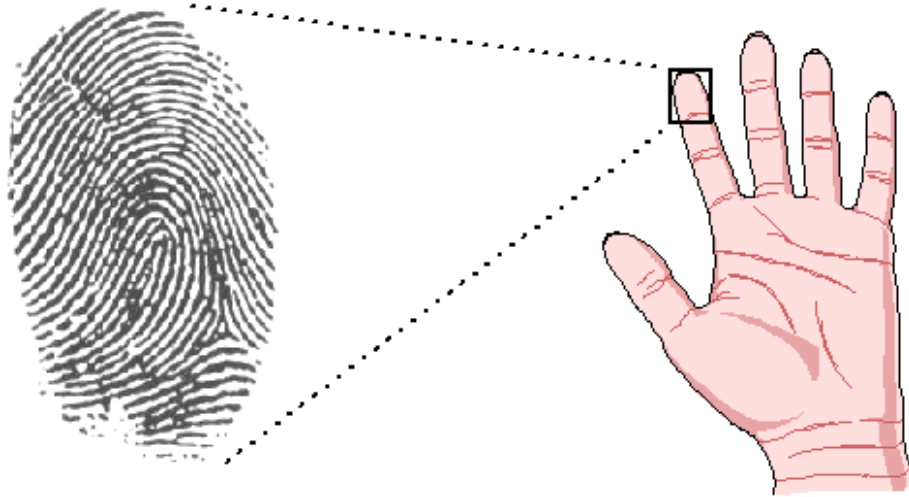
Plain arch

Tented arch

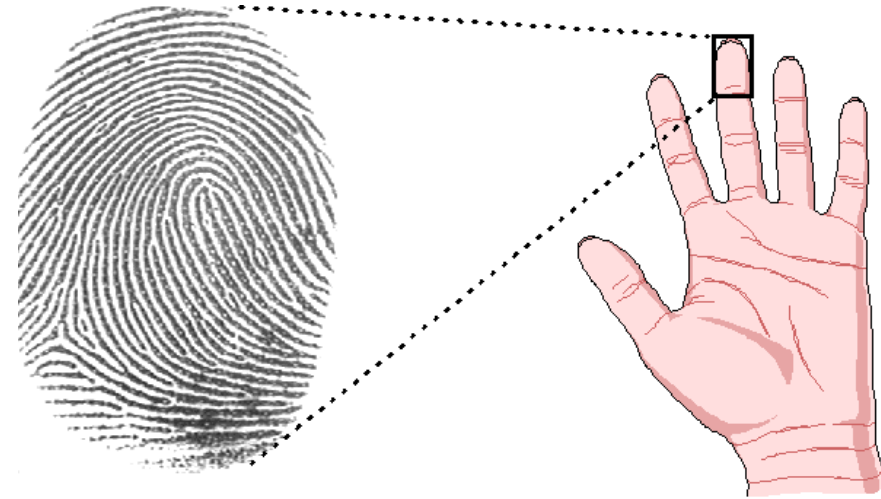
Plain whorl

Loop (r or u)

Which Loop is it?



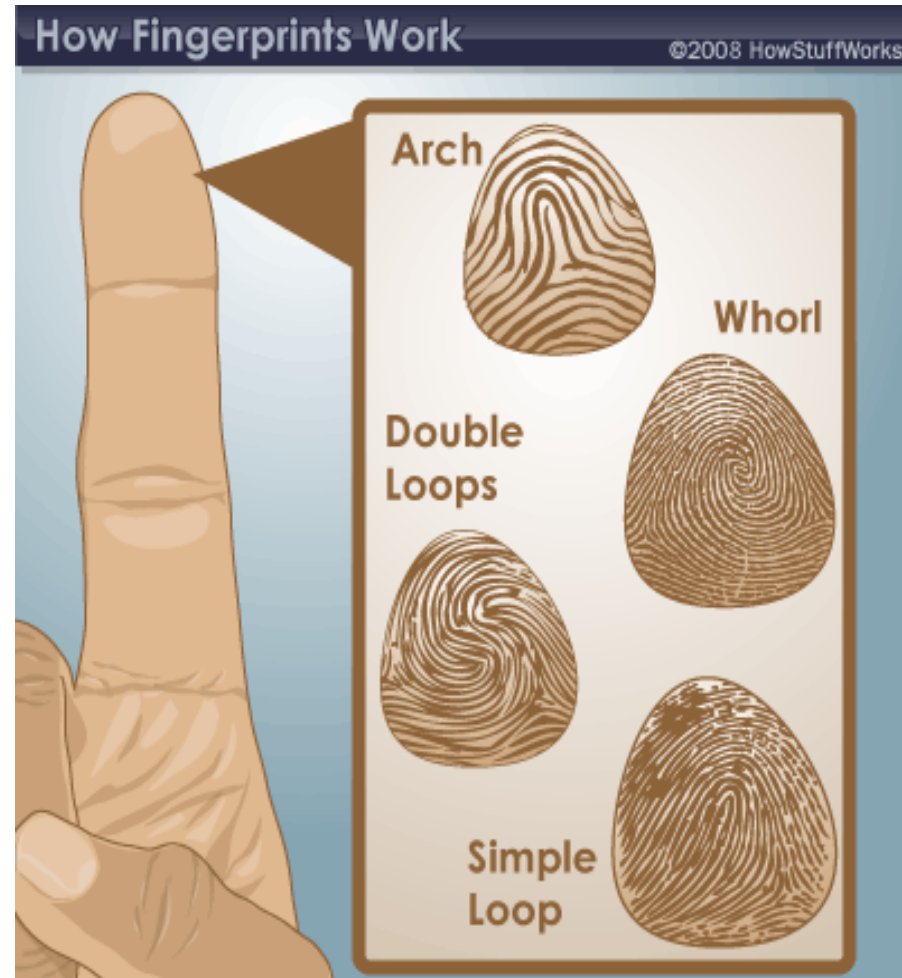
ulnar



radial

The Henry System (1899)

1. Classification system using all 10 fingers. Based on identifying the patterns of each finger.
2. 1,024 labels are created.
3. Still used today.



4. The fingerprint record is filed under its label
5. To locate a record, only 1 / 1,024th of the entire collection must be examined

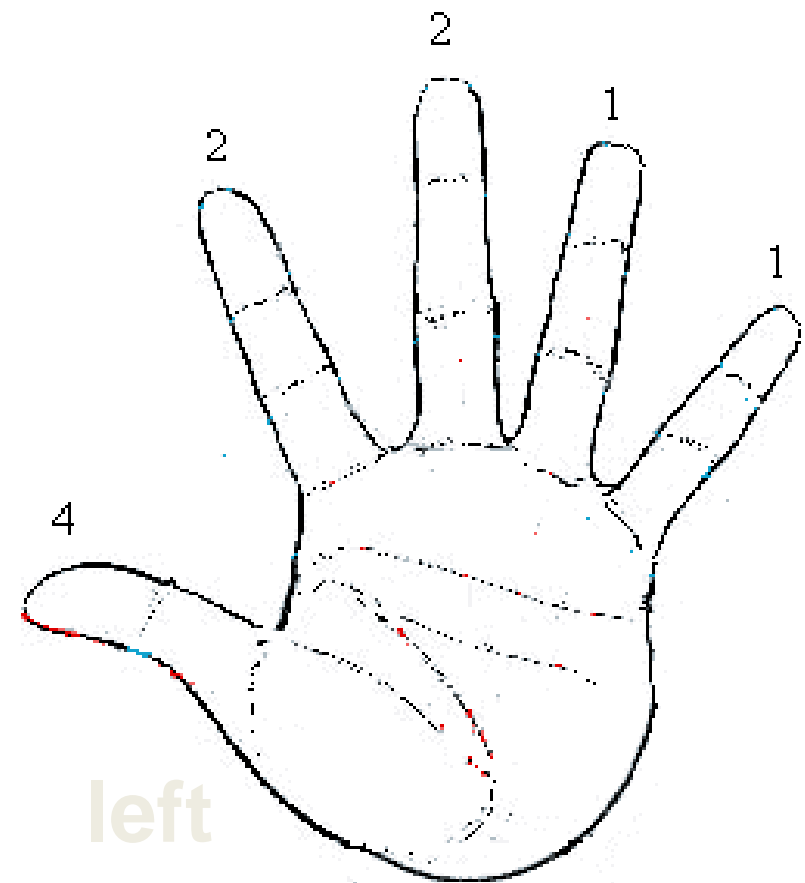
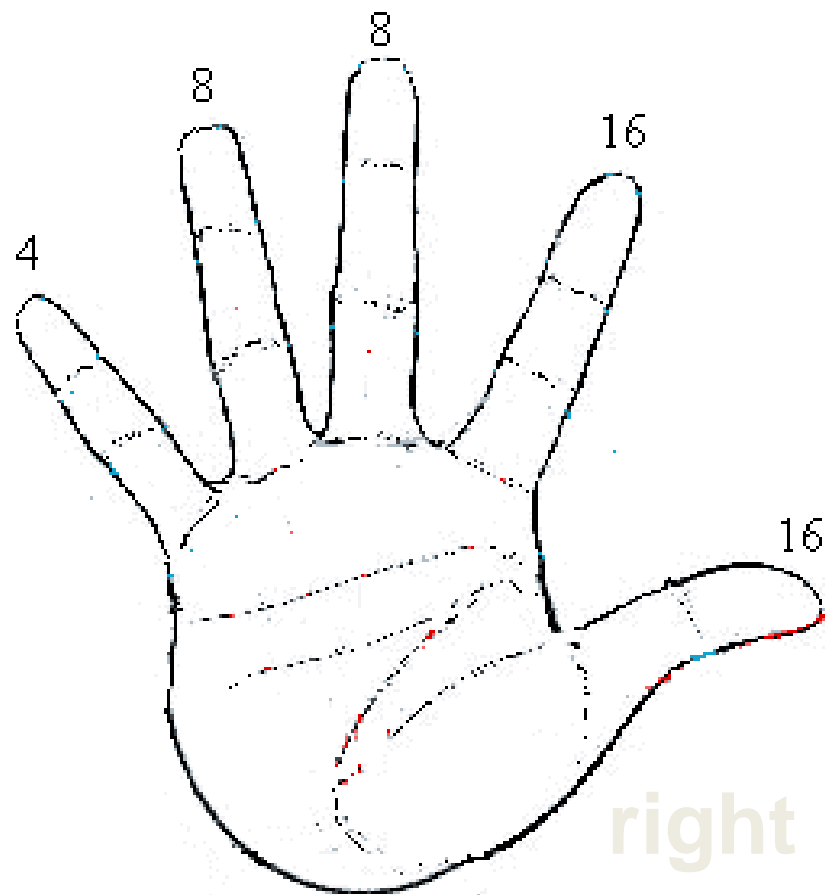


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1. RIGHT THUMB		2. RIGHT INDEX		3. RIGHT MIDDLE		4. RIGHT RING		5. RIGHT LITTLE		6. LEFT THUMB		7. LEFT INDEX		8. LEFT MIDDLE		9. LEFT RING		10. LEFT LITTLE		LEFT FOUR FINGERS TAKEN SIMULTANEOUSLY		LEFT THUMB		RIGHT THUMB		RIGHT FOUR FINGERS TAKEN SIMULTANEOUSLY		8. 403/902		ISP6-408 (181)					

Step 1: Determine which fingers have whorls



Step 2: Each finger is given a point value



Step 3: Set up a ratio

Assign the number of points for each finger that has a whorl and substitute into the equation:

$$\frac{\begin{array}{cccccc} \text{right} & \text{right} & \text{left} & \text{left} & \text{left} & \\ \text{index} & \text{ring} & \text{thumb} & \text{middle} & \text{little} & + 1 \end{array}}{\begin{array}{cccccc} \text{right} & \text{right} & \text{right} & \text{left} & \text{left} & \\ \text{thumb} & \text{middle} & \text{little} & \text{index} & \text{ring} & + 1 \end{array}} = \underline{\hspace{2cm}}$$

That number is your primary classification number.

Example 1

A suspect has whorls on her right index, left ring and right little fingers.

What is her Henry classification number?

2. right
index

4. right
ring

6. left
thumb

8. left
ring

10. left
little

16

8

4

2

1

+ $\frac{1}{1}$

16

8

4

2

1

1. right
thumb

3. right
middle

5. right
little

7. left
index

9. left
little

What is the ratio if all 10 fingers have whorls?

32/32

2. right
index

16

4. right
ring

8

6. left
thumb

4

8. left
ring

2

10. left
little

1

+ $\frac{1}{1}$

1. right
thumb

16

3. right
middle

8

5. right
little

4

7. left
index

2

9. left
little

1

What is the ratio if no fingers have whorls?

1/1

25% of the population

2. right
index

16

4. right
ring

8

6. left
thumb

4

8. left
middle

2

10. left
little

1

+ $\frac{1}{1}$

16

8

4

2

1

1. right
thumb

3. right
middle

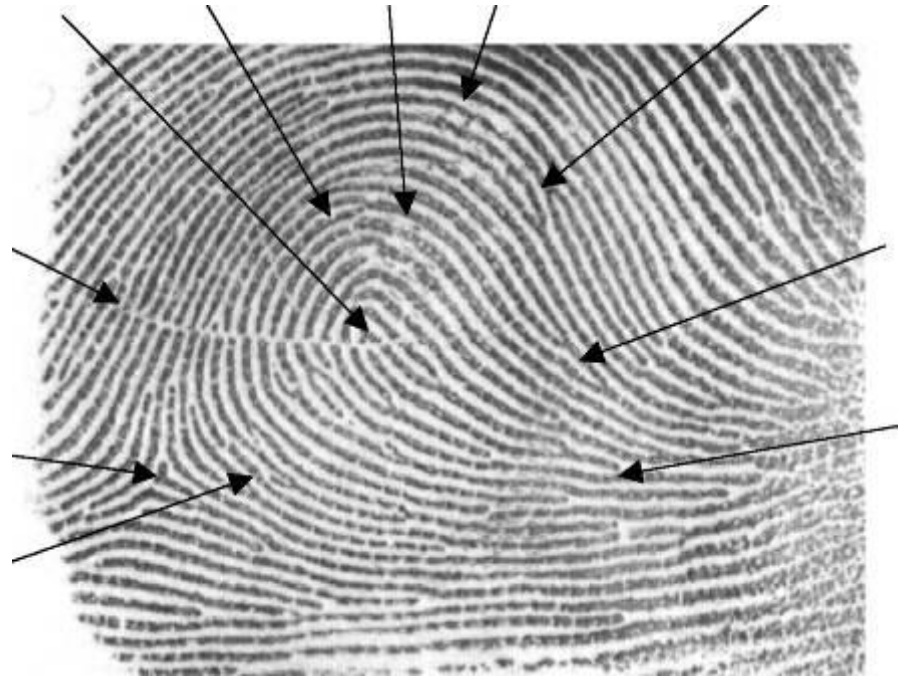
5. right
little

7. left
index

9. left
ring

Comparison of Prints

1. There are no legal requirements in the United States on the number of points required for a match.
2. Generally, criminal courts will accept 8 to 12 points of similarity.



Latent Prints

1. Latent fingerprints are those that are not visible to the naked eye. These prints consist of the natural secretions of human skin and require development for them to become visible
2. **Most secretions come from three glands:**
 - **Eccrine**—secretes largely water, with both inorganic (ammonia, chlorides, metal ions, phosphates) and organic (amino acids, lactic acids, urea, sugars) compounds. Most important for fingerprints.
 - **Apocrine**—secretes pheromones and other organic materials.
 - **Sebaceous**—secretes fatty or greasy substances.

Developing Latent Prints

1. Developing a print requires substances that interact with secretions, causing the print to stand out against its background. It may be necessary to attempt more than one technique, done in a particular order so as not to destroy the print.
2. In modern labs and criminal investigations, lasers and alternative light sources are used to view latent fingerprints. These were first used by the FBI in 1978. Since lasers can damage the retina of the eye, special precautions must be taken.
3. **Powders**—adhere to both water and fatty deposits. Choose a color to contrast with background.
4. **Silver nitrate**—reacts with chloride to form silver chloride, a material that turns gray when exposed to light.

5. **Ninhydrin**—reacts with amino acids to produce a purple color.
6. **Silver nitrate**—reacts with chloride to form silver chloride, a material that turns gray when exposed to light.
7. **Cyanoacrylate**—“superglue” fumes react with water and other fingerprint constituents to form a hard, whitish deposit.

Other ways of locating Latent Prints

1. **RUVIS** - Reflected UV Imaging System
2. UV light is used to locate latent prints
3. Chemicals can also be used



Developing fingerprints using powders

1. Used on hard, non porous surfaces
2. Glass, mirror, metals, painted wood, tile, your desk, etc...



3. Adhere (stick) to water and fatty deposits in prints.

- Use black (charcoal) for light surfaces
- Use gray (aluminum) for dark surfaces



4. Magnetic Powder - special “brush” **won't smudge print** (leather, rough plastic). Works better on shiny surfaces or plastic baggies or containers.
5. Fluorescent Powder - print glows with UV light



Developing Fingerprints Using Iodine

1. Heating iodine crystal causes sublimation (Liquid to Gas)
2. Fumes react with oils on skin
3. Temporary yellow brown print
4. To last longer spray with starch to set iodine.
5. Photograph after the treatment – permanent record.
6. Use on porous surface

