

FINGERPRINTS



What are fingerprints?

- Friction ridge skin pattern
- Found on fingers, palms, toes, soles of feet.
- Composed of ridges (hills) and furrows (valleys)



Black = Ridges
White = Valleys

- Develop in early embryonic development.
- Pattern based on genetics, detail somewhat random
- Identical twins **do not** have identical fingerprints



Fingerprint Principles

According to criminal investigators, fingerprints follow 3 fundamental principles:

- 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.

Fingerprint Classes

There are 3 specific classes for all fingerprints based upon their visual pattern: arches, loops, and whorls.



Each group is divided into smaller groups as seen in the lists below.

Arch

Plain arch
Tented arch

Loop

Radial Loop
Ulnar loop

Whorl

Plain whorl
Central pocket whorl
Double loop whorl
Accidental

**Fingerprint Factoid:
60% of people have loops, 35% have
whorls,
and 5% have arches**

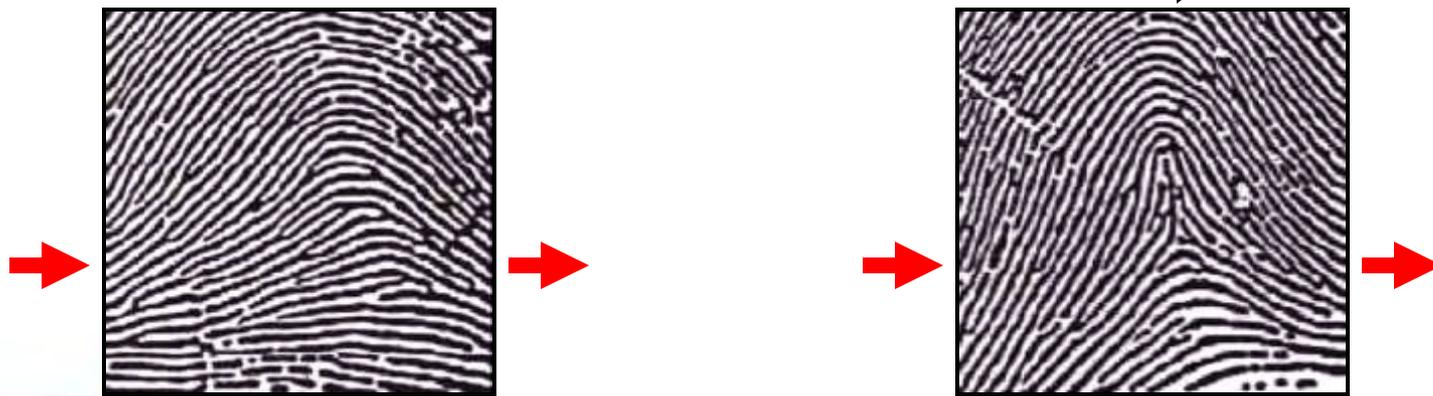
Did you know?

Dactyloscopy is the study of fingerprint identification.
Police investigators are experts in collecting
“dactylograms”, otherwise known as 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.



Plain Arch

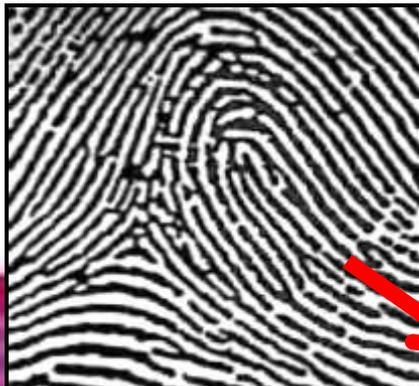
Ridges enter on one side and exit on the other side.

Tented Arches

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

Loops

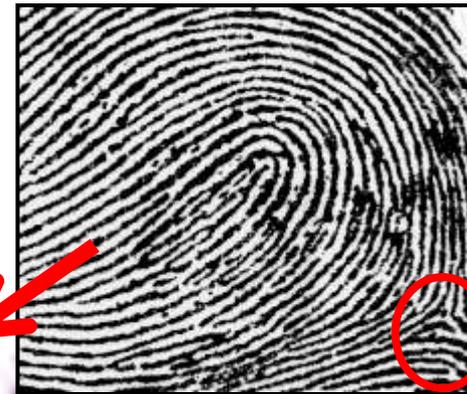
Loops must have one delta and one or more ridges that enter and leave on the same side. These patterns are named for their positions related to the radius and ulna bones, i.e. the bone the loop opening is facing towards.



L – Radial Loop
R - Ulnar Loop



Delta

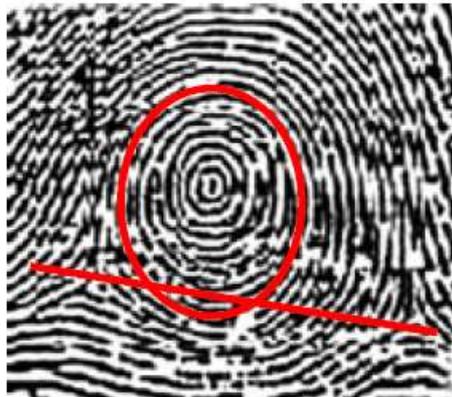


L – Ulnar Loop
R - Radial Loop

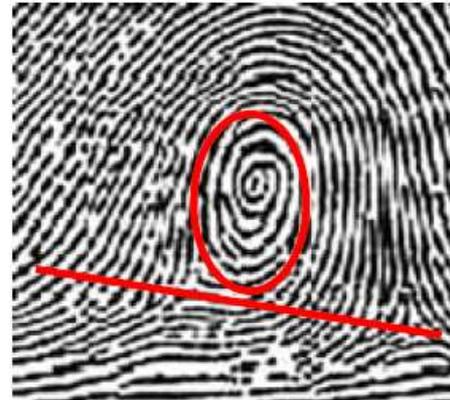
Whorls

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.

Plain
Whorl



Central
Pocket
Whorl



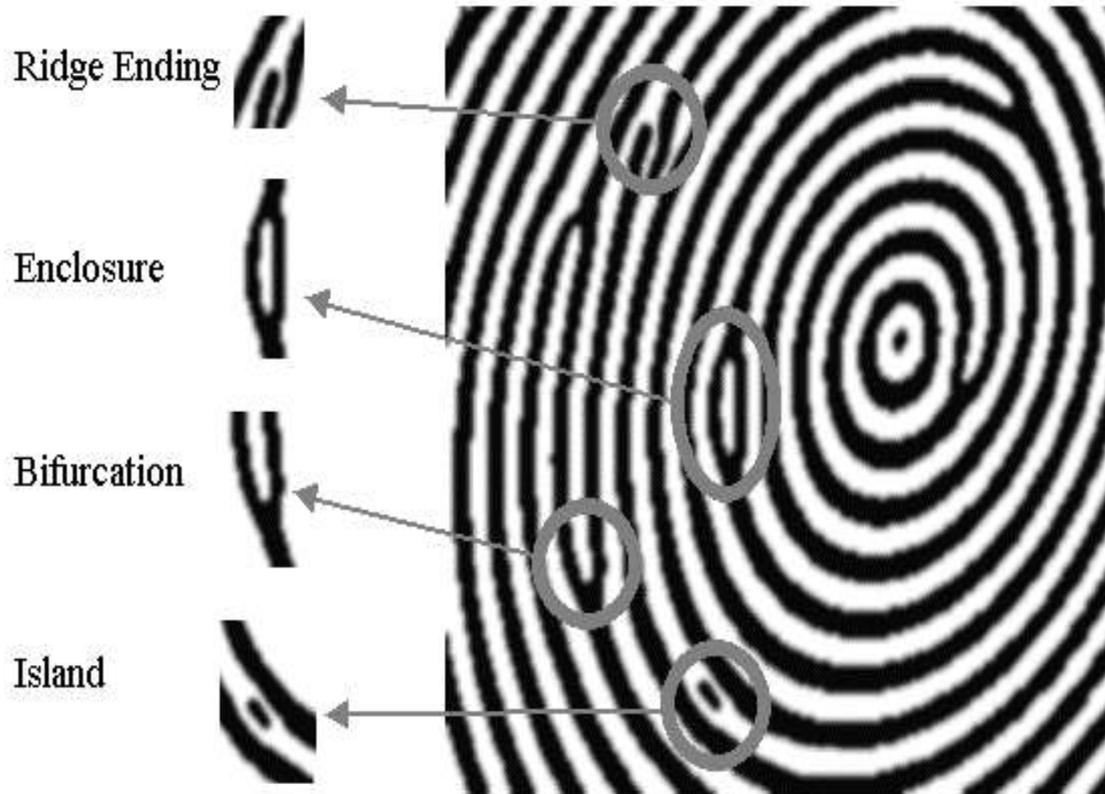
How are fingerprints analyzed?



Categorized by **pattern** and **minutiae**

Minutiae

- In forensic science, minutiae are major features of a fingerprint, using which comparisons of one print with another can be made. Minutiae include:
- Ridge ending – the abrupt end of a ridge
- Ridge bifurcation – a single ridge that divides into two ridges
- Island – a single small ridge inside a short ridge or ridge ending that is not connected to all other ridges
- Ridge enclosure – a single ridge that bifurcates and reunites shortly afterward to continue as a single ridge
- Delta – a Y-shaped ridge meeting
- Core – a U-turn in the ridge pattern



Patterns

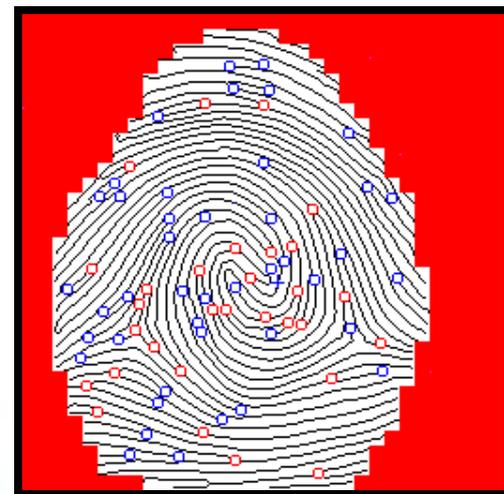
The three basic patterns of fingerprint ridges are:

- arch
- loop
- whorl



Modern Fingerprint Analysis

- Computer system stores patterns and minutiae of prints
 - AFIS: automated fingerprint identification system



AFIS

- The Automated Fingerprint Identification System - a computer system for storing and retrieving fingerprints
- Began in the early 1970's to:
 - Search large files for a set of prints taken from an individual
 - Compare a single print, usually a latent print developed from a crime scene



■ By the 1990's most large jurisdictions had their own system in place. The problem - a person's fingerprints may be in one AFIS but not in others

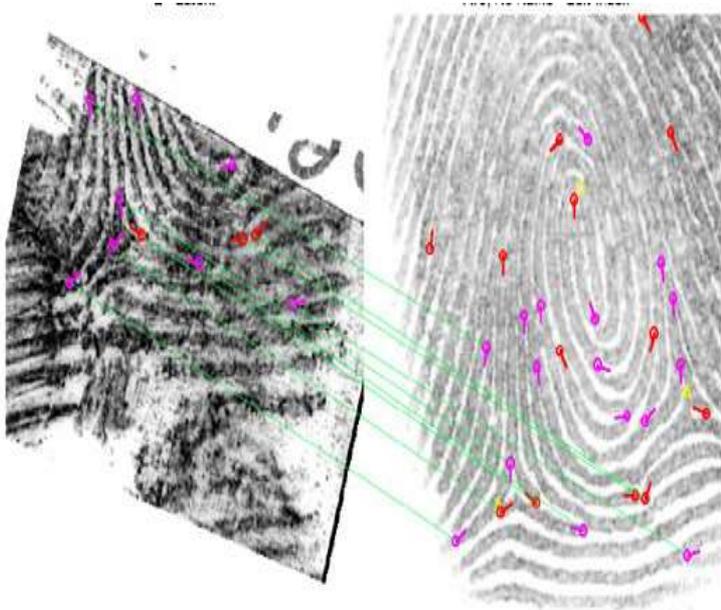
■ IAFIS—the FBI's Integrated Automated Fingerprint Identification system which is



Ten print entry card

- IAFIS can categorize, search and retrieve fingerprints from virtually anywhere in the country in as little as 30 minutes.
- It also includes mug shots and criminal histories on some 47 million people.
- IAFIS allows local, state and federal law enforcement agencies to have access to the same huge database of information

Automated Fingerprint Identification System (AFIS)



AFIS is a computerized system of a database capable of reading, classifying, matching, and storing fingerprints for criminal justice agencies. AFIS collects digital fingerprints with sensors. Computer software then looks for patterns and minutiae points (based on Sir Edward Henry's system) to find the best match in its database.

Quality latent fingerprints are entered into the AFIS for a search for possible matches against the state maintained databases for fingerprint records to help establish the identity of unknown deceased persons or suspects in a criminal case.



There are 3 types of fingerprints

1. **Visible** – left by dirt, grease, blood, etc.
 - Does not need processing



2. **Impression** – indentation in soft material (butter, putty, tar, etc.)
- Does not need processing



3. **Latent** – requires processing to make visible and suitable for analysis



What are the invisible components?

Multiple sweat glands secrete onto fingers, palms, etc.

Sweat contains:

- Inorganic ions (Na^+ , Cl^-)
- Proteins, amino acids
- Lipids
- Other



Development and Collection:

Scene or Lab?

- No rule: Depends on situation
- Fingerprint **must be photographed** after development (scene or lab)



Physical Development: Dusting

- Apply powder to latent print or area.
- Powder adheres to print.

Brush and Powder



Physical Development: Dusting

- Apply powder to latent print or area.
- Powder adheres to print.

Magnetic Brush
and Powder



Chemical Development:

1. Silver Nitrate

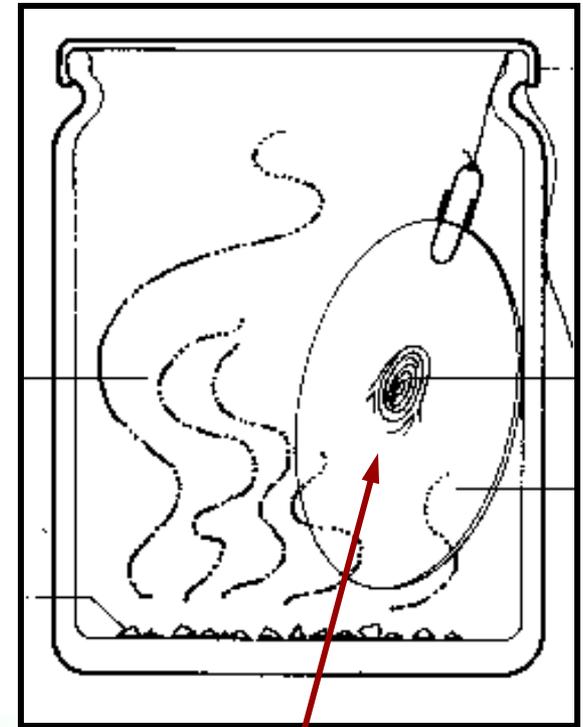
- No longer used (messy, not sensitive)
- Silver reacts with Cl^- ions in print



Chemical Development:

2. Iodine Fuming

- Iodine sublimes (solid \rightarrow gas)
- Iodine reacts with lipid components; becomes trapped in the print.
- Fuming wand or chamber

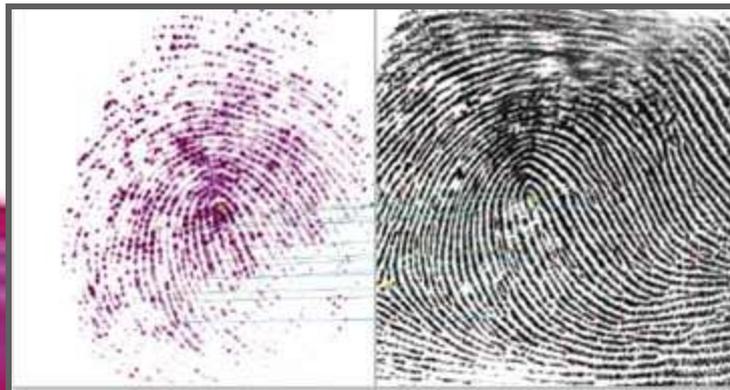


Dirty Brown Color

Chemical Development:

3. Ninhydrin

- Reacts with amino acids; purple color
- Painted or sprayed on area
- Heated to react



Chemical Development:

4. Super glue fuming

- Fumes with heat or base (NaOH)
- Fumed in cabinets
- Off-white print



Chemical Development:

Ninhydrin and super glue prints can be further processed:

- Dusted
- Chemically treated to fluoresce (using laser or alternative light)



Collection of prints:

Tape lift:

- Tape placed over developed print
- Tape then placed on white card.



Collection of prints:

Sometimes a photograph will be the only permanent record



THANK YOU!!!!!!

