Fingerprints

Summary

- What are fingerprints?
- How are fingerprints analyzed?
- How are fingerprints collected?

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

What are fingerprints?

Develop in early embryonic development.

Pattern based on genetics, detail somewhat random

Identical twins **do not** have identical fingerprints

How are fingerprints analyzed?

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

How are fingerprints analyzed?

Patterns

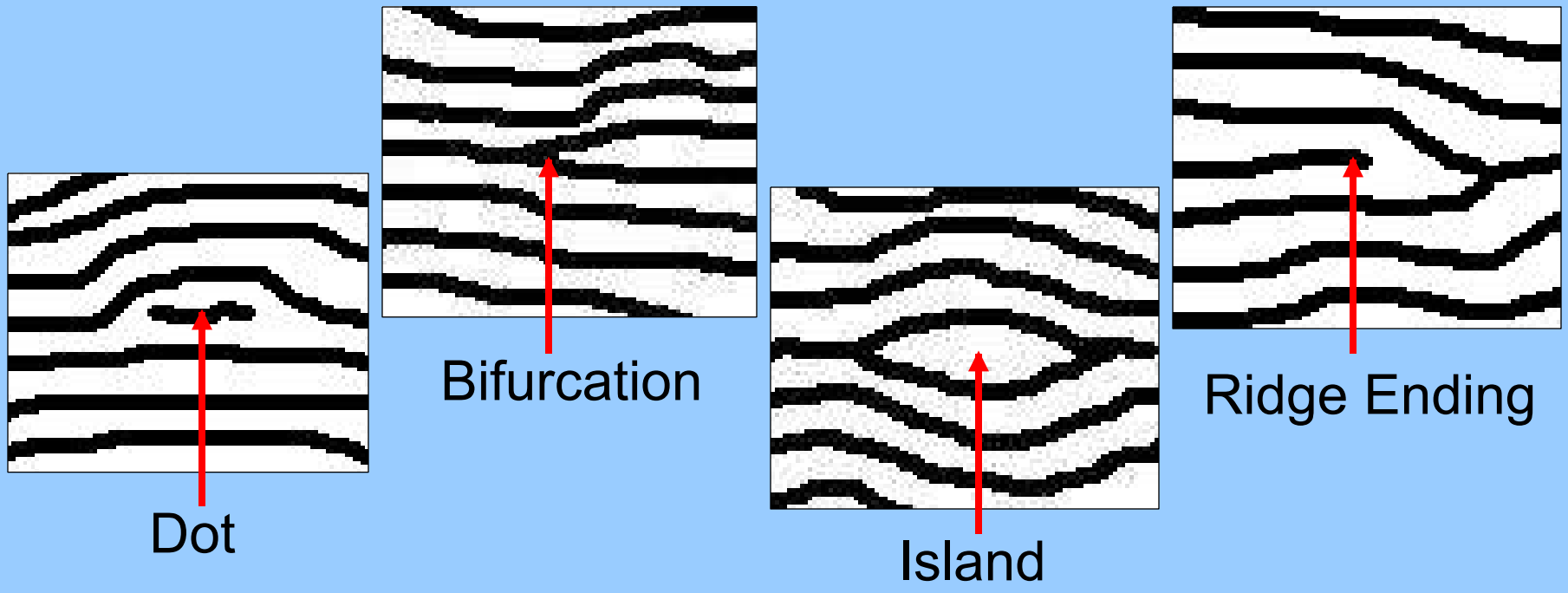
Arch

Loop

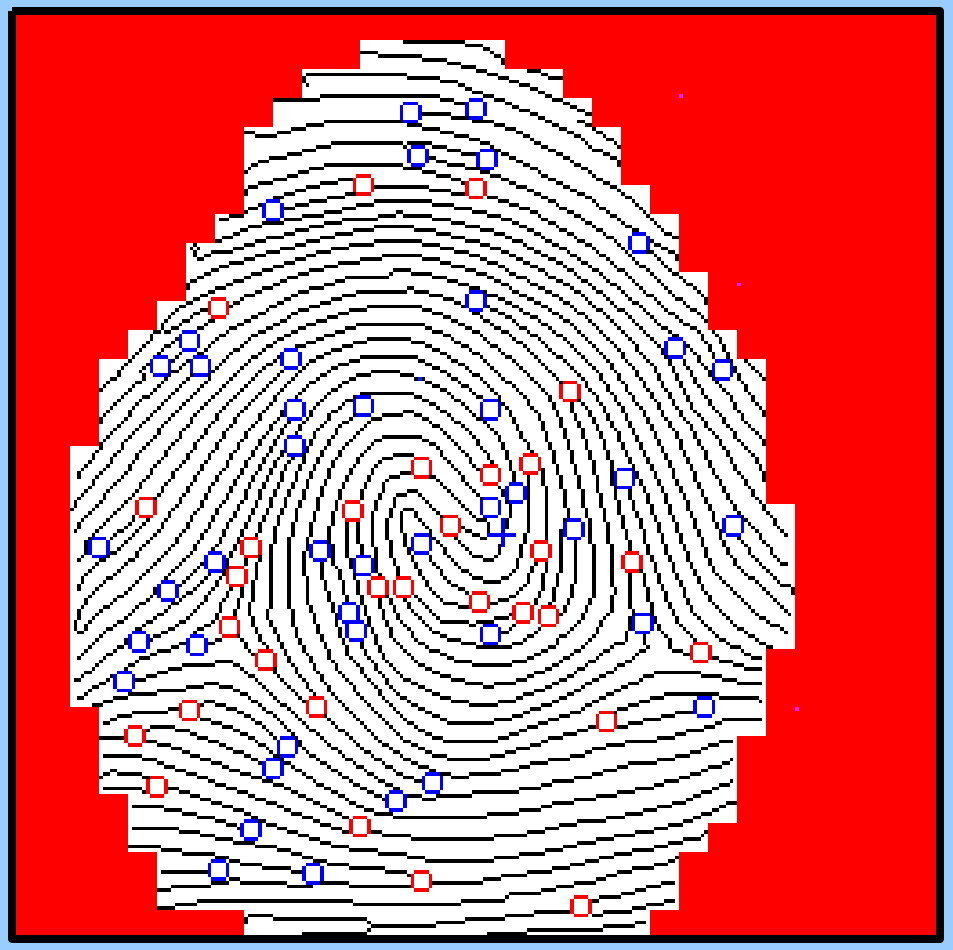
Whorl

How are fingerprints analyzed?

Minutiae



Fingerprints



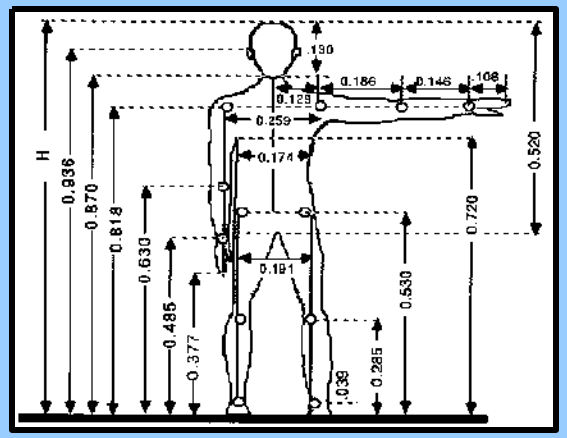
Computer software compares the location of these minutiae.

History of Fingerprints

Long history of fingerprints as signature

Criminal identification first done by a system of body measurements called **anthropometry**.

Bertillon's anthropometry system used 11 body measurements to identify an individual



History of Fingerprints

Henry invented a system for **classifying** fingerprints.

Allowed fingerprint records to be searched.

Based on all 10 prints, so matching one print would be difficult.

Fingerprints

KEY	MAJOR	PRIMARY	SECONDARY	SUBSECONDARY	FINAL
10	M	19	U	IMP	1
	14	21	W	OIM	

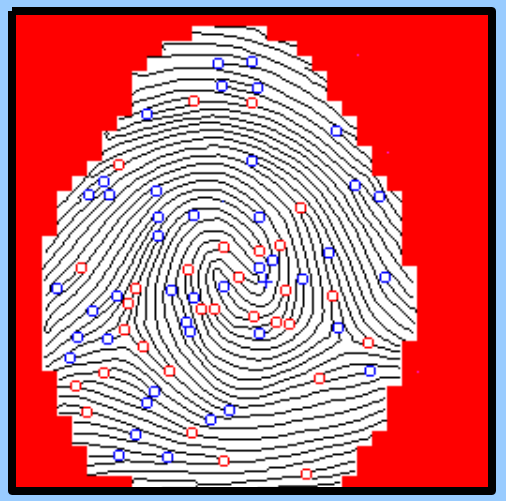
KEY = The ridge count of the first loop pattern excluding the little fingers
MAJOR = Value of the ridge counts of the loop patterns or the tracings of the whorls patterns on the thumbs (fingers #1 and #6).
PRIMARY = Summation of the vlaue of the whorl patterns for fingers numbered 2, 4, 6, 8, and 10 for the numerator (top). Summation of the value of the whorl patterns for fingers numbers 1, 3, 5, 7, and 9 for the denominator (bottom). Add 1 to both the numerator and denominator.
SECONDARY = Pattern types located in the index fingers (#2 and #7).
SUBSECONDARY = Value of the ridge counts of the loops or the tracings of the whorls for fingers #2, #3, and #4 in the numerator (top) and #7, #8, and #9 in the denominator (bottom).
FINAL = The ridge count of the loop in the right little finger (#5), if it is not a loop then use the left little finger (#10). If there is no loop in either of the little fingers, then there is no final.

Figure 15.11 Summary of modified Henry system fingerprint classification.

Modern Fingerprint Analysis

Computer system stores patterns and minutiae of prints

AFIS: automated fingerprint identification system



There are 3 types of fingerprints

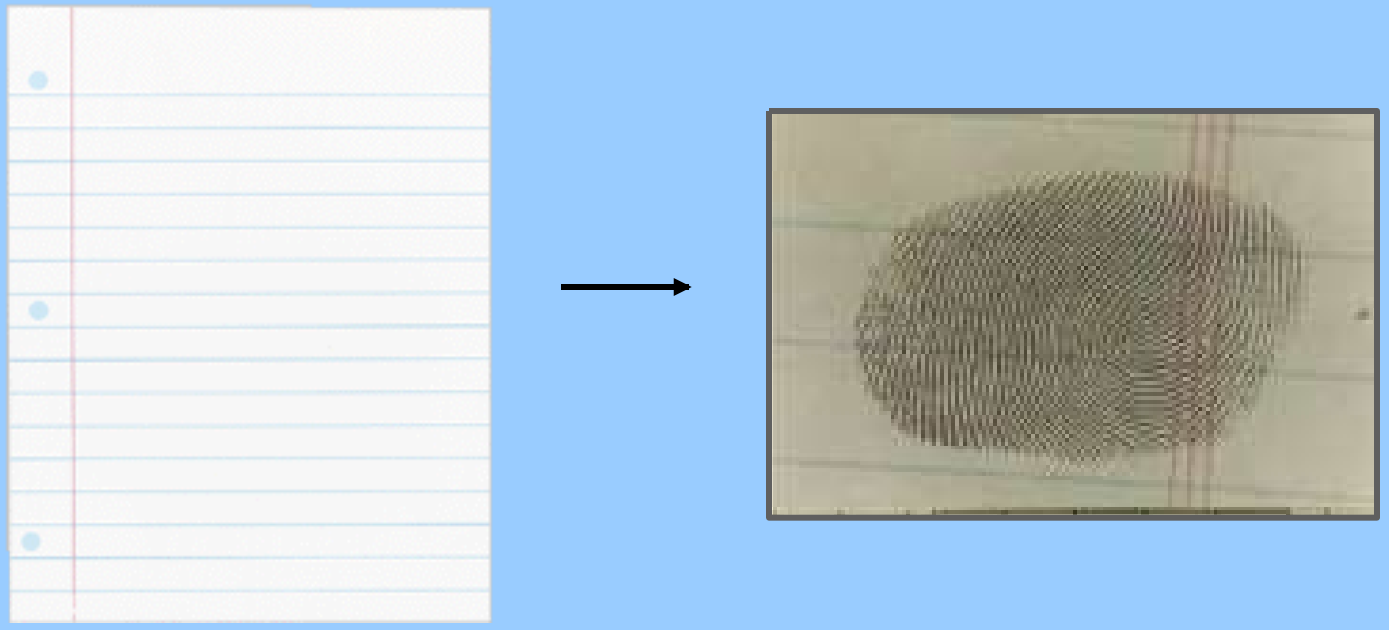
1. Visible – left by dirt, grease, blood, etc.
   - § Does not need processing

There are 3 types of fingerprints

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

There are 3 types of fingerprints

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.

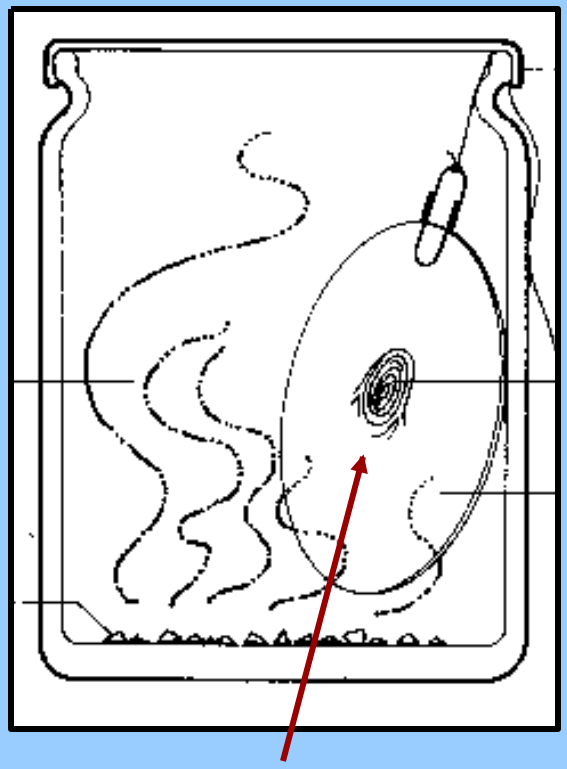
Magnetic Brush and Powder

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 → 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.