



Fingerprints

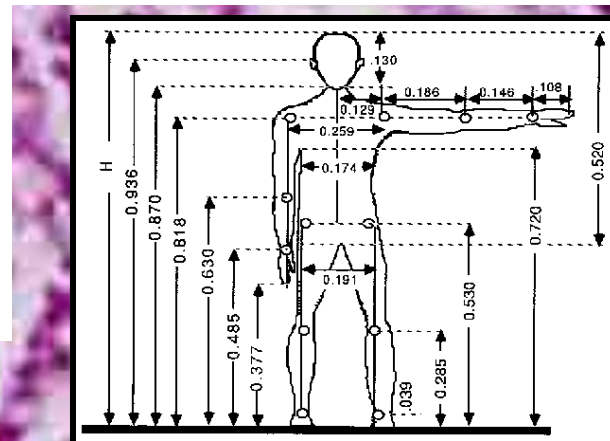


Summary

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

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

- **Dermatoglyphics**-the study of skin (derma=skin and glyph=picture or symbol)
- **Sir Francis Galton** classified and named the three main pattern types. **Henry** later invented a grouping system for **classifying** fingerprints.
- Henry system 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 14	19 21	U W	IMP OIM	1

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 value 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.

Fingerprints

What are fingerprints?

- Friction ridge skin pattern- actually doesn't aid gripping
- Found on fingers, palms, toes, soles of feet.
- Composed of ridges (hills) and furrows (valleys)



Black = Ridges
White = Valleys

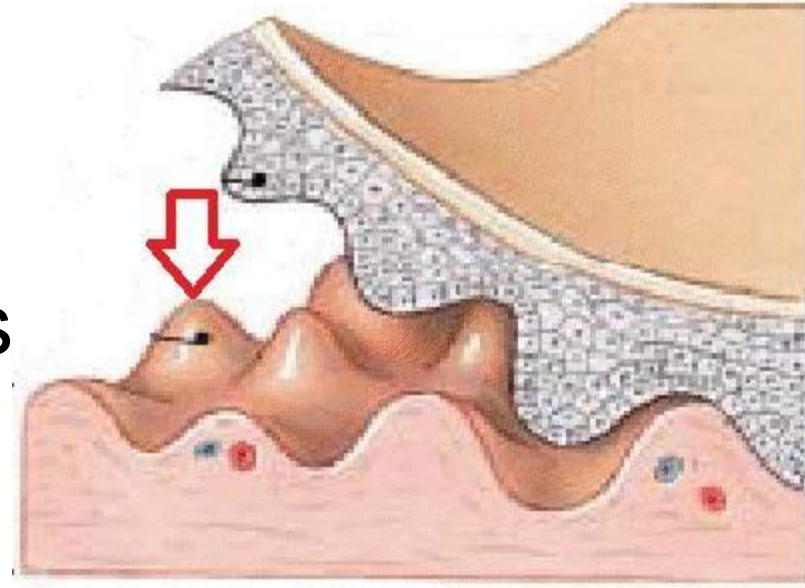
What are fingerprints?

- Develop in early embryonic development (1:26):

<http://study.com/academy/lesson/the-integumentary-system-the-dermal-layer.html>

- Pattern based on genetics detail somewhat random
- Identical twins **do not** have identical fingerprints

Dermal papillae
(underneath epidermis)



Fingerprints

How are fingerprints analyzed?

The *practice of identifying* fingerprint patterns and detail is called **dactyloscopy** (dactyl=finger and scopy=viewing/looking)



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

Fingerprints

How are fingerprints analyzed?

Patterns



Arch



Loop



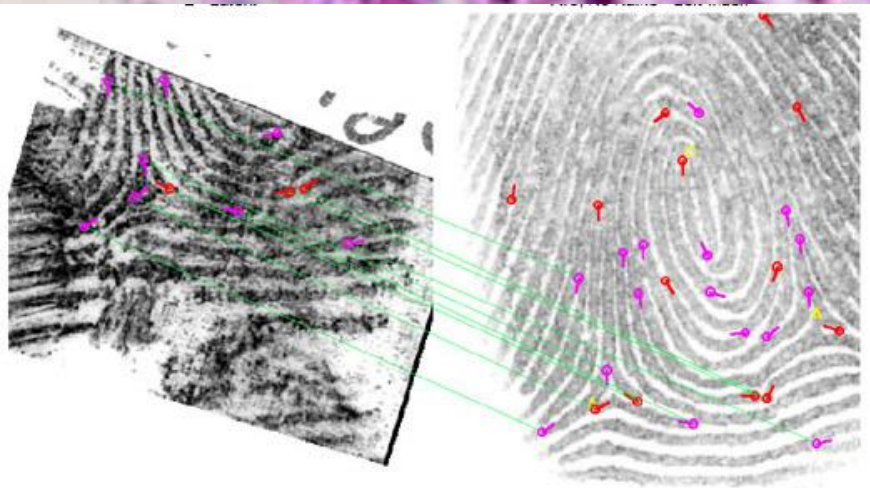
Whorl

Fingerprint Identification

When minutiae on two different prints match, these are called points of **similarity** or points of **identification**. At this point there is **no** international standard for the number of points of identification required for a match between two fingerprints. The United States does not have a minimum, however the United Kingdom requires a minimum **sixteen** points while Australia and Germany only require **twelve**.

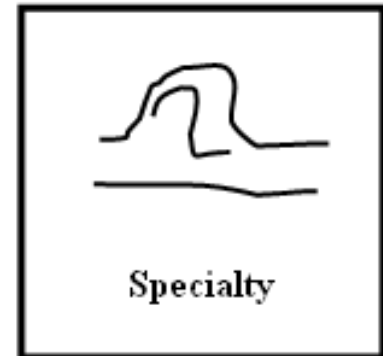
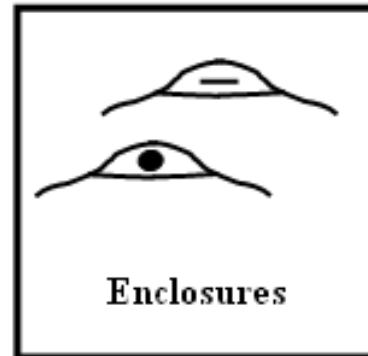
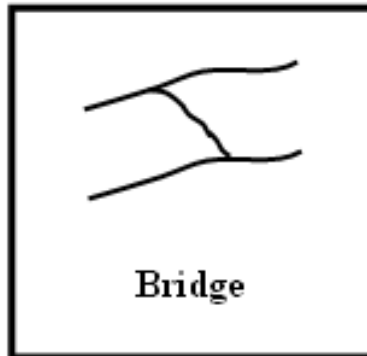
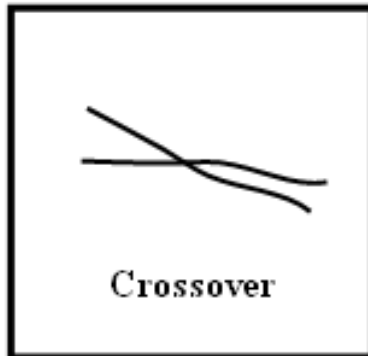
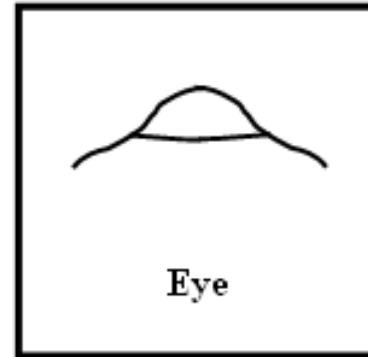
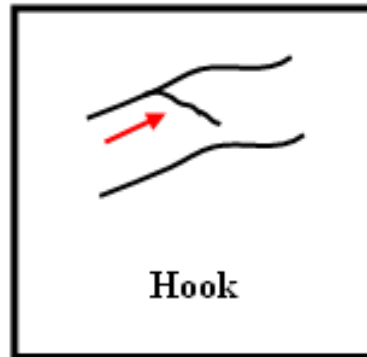
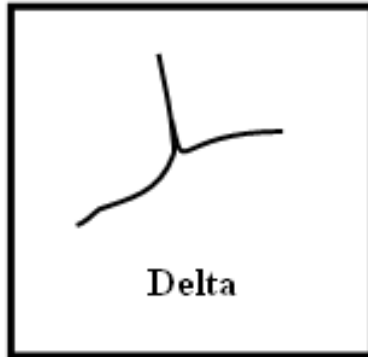
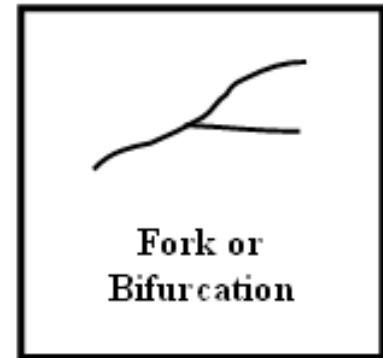
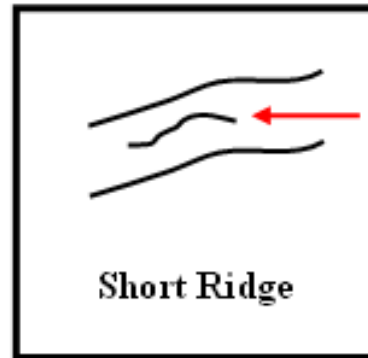
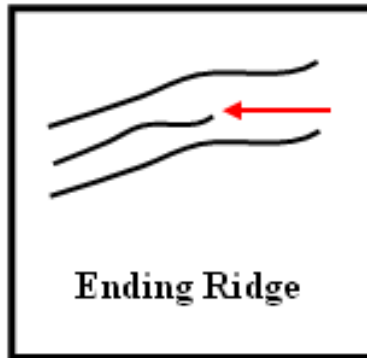
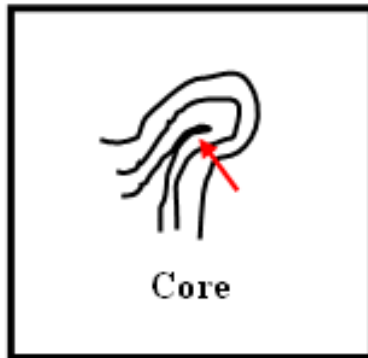


Automated Fingerprint Identification System (AFIS)



AFIS is a computerized system capable of reading, classifying, matching, and storing fingerprints for criminal justice agencies. 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.

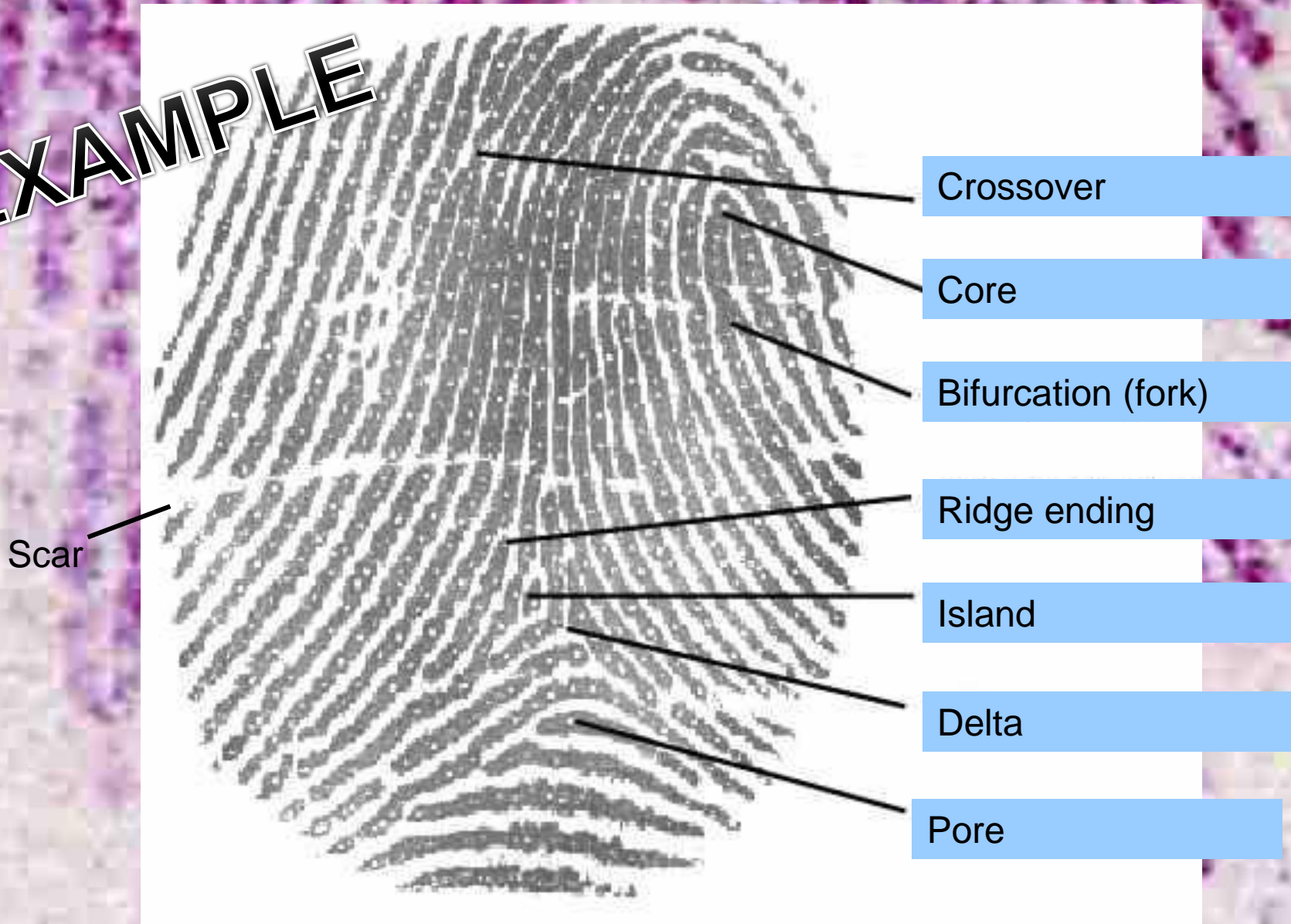
Ridge Characteristics



Use these characteristics as points of identification when comparing fingerprint samples. The more points you can find in common, the better the match!

Ridge Characteristics

EXAMPLE



FINGERPRINT COMPARISON

EXAMPLE #1



EXAMPLE #2



How many ridge characteristics can you identify in this fingerprint?



Try It!

- 1 – **Exemplar prints**-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?

Fingerprints

**Prints that are known are called exemplar.
There are 3 types of “un-identified”
fingerprints that are left at crime scenes;**

1. Patent prints – visible prints left by dirt, grease, blood, etc.
 - Does not need processing-only photographed and lifted with tape for analysis



Fingerprints

There are 3 types of fingerprints

2. Plastic prints-Impressions or indentations in soft material (paint, wax, butter, putty, tar, etc.)
 - Does not need processing



People vs. Jennings 1911

MATCH HANDS TO HANG A MAN

Judge Permits Comparison of Finger Prints Slayer Left,

ARE IDENTICAL IN 33 POINTS.

Murderer's Marks in Wet Paint Night He Killed Miller Shown.

Fingerprints

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 (*in situ*) or Lab?

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

Physical Development: Dusting

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

Brush and magnetic
Powder



Chemical Development:

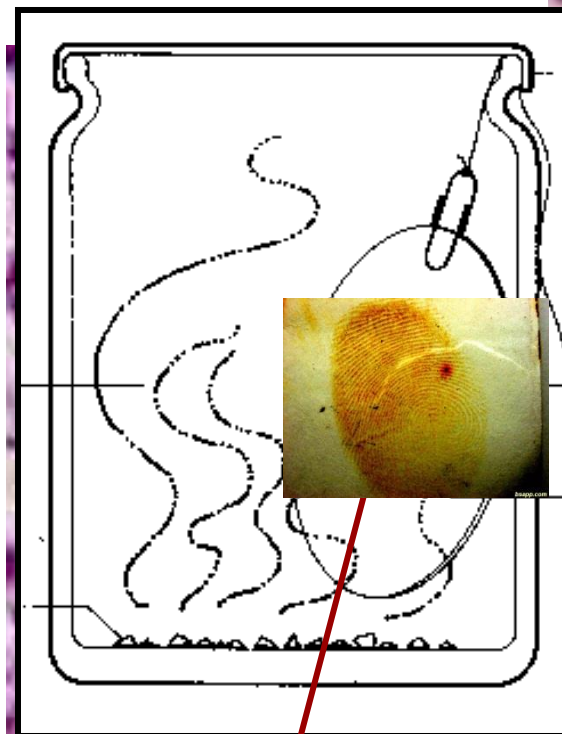
1. Silver Nitrate

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

Chemical Development:

2. Iodine Fuming

- Iodine sublimates (solid → gas)
- Iodine reacts with **lipid** components; becomes trapped in the print.
- Fuming wand or chamber
- Doesn't last more than 24 hours, so often used **first** and in conjunction with other methods



Dirty Brown Color

Chemical Development:

3. Ninhydrin

- Reacts with amino acids; purple color
- Painted or sprayed on porous surfaces like clothing/fabric
- Heated to react



Chemical Development:

3. Vacuum metal deposition

- Gold and zinc “powders” are placed in vacuum with evidence and sticks to fingerprints
- Works well for porous surface—especially clothing and fabric



<https://www.youtube.com/watch?v=DSnjtg1n8Ag>

Chemical Development:

4. Super glue fuming

- Cyanoacrylate abbreviated CA
- 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:

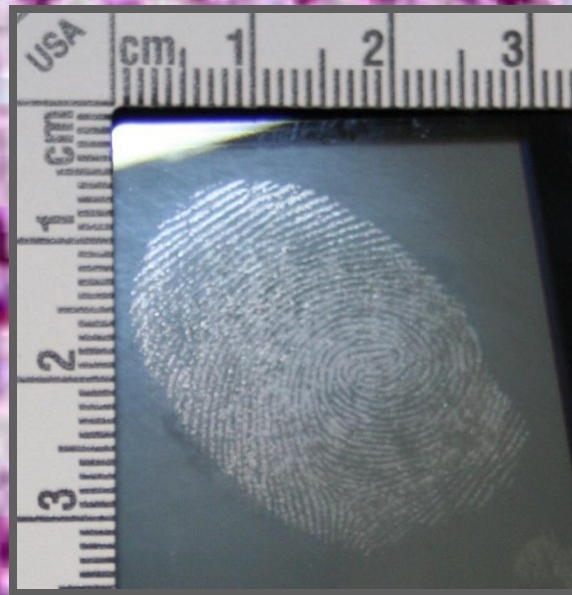
Tape lift:

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



Collection of prints:

Sometimes a photograph will be the only permanent record.



Fingerprint removal:

Criminals often try to remove their fingerprints from their fingers to avoid I.D. Can you think of ways that someone might be able to permanently remove their “Friction ridges”?

Attempted fingerprint removal methods:

Acid

Surgery- scarring or grafting skin

Burning

**Superglue can be used as a temporary
“hiding” method*

Fingerprints > Removal

Fingerprint removal methods:

John Dillinger (infamous bank robber of 1930's) tried to remove his fingerprints with a strong acid. However, just like in most cases, the sub-dermal skin layers regenerate in about 30 days and the same ridges re-appeared



Fingerprints > Removal

Fingerprint removal methods:

Robert J. Philipps successfully removed his fingerprints by paying a plastic surgeon to graft skin from his chest onto his finger tips.

The surgery didn't hide the ridges on the sides of his fingers though and forensic investigators were able to match those areas for a positive I.D.



Robert J. Philipps, showing areas where skin was grafted to fingers to destroy fingerprints.

Fingerprints > Removal

Fingerprint removal:



Chemotherapy can also cause a loss of fingerprints. “Hand-foot syndrome” occurs when chemo drugs leak out through small blood vessels in the hands and feet and can cause swelling and redness that makes fingerprints and footprints “disappear”

Fingerprints

Adermatoglyphia

The Genetic Disorder Of People Born Without Fingerprints





Fingerprints > Disguise

Fingerprint hiding methods:

Super glue

Cyanoacrylate

