Fingerprints

EHS BioMed/Forensics

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.

Ea[illegible]p is divided into smaller groups
[illegible]n in the lists below.

Arch	**Loop**	**Whorl**
Plain arch	Radial Loop	Plain whorl
Tented arch	Ulnar loop	Central pocket whorl
		Double loop whorl
		Accidentical

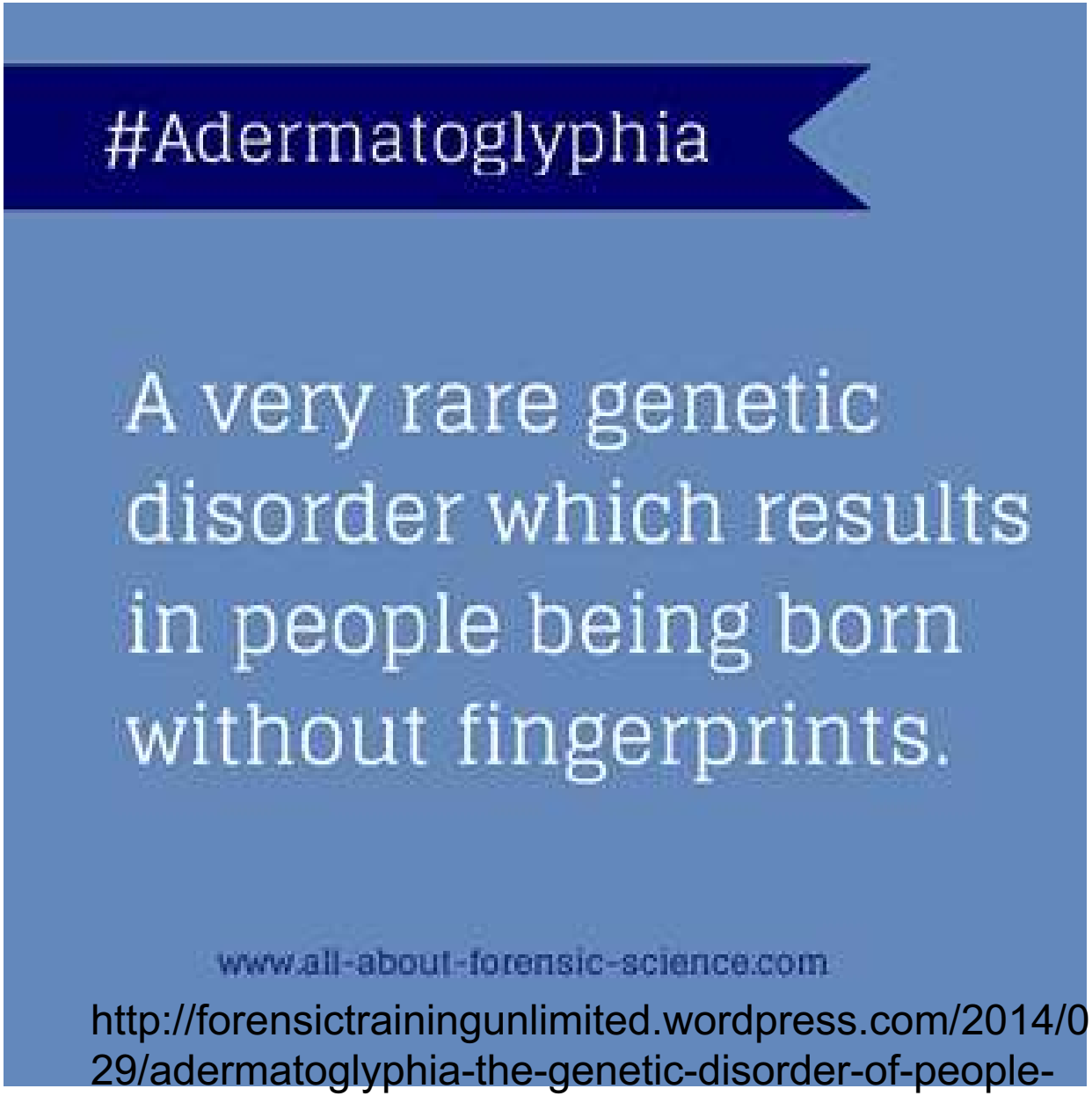
Interesting Info

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.

ADD TO NOTES

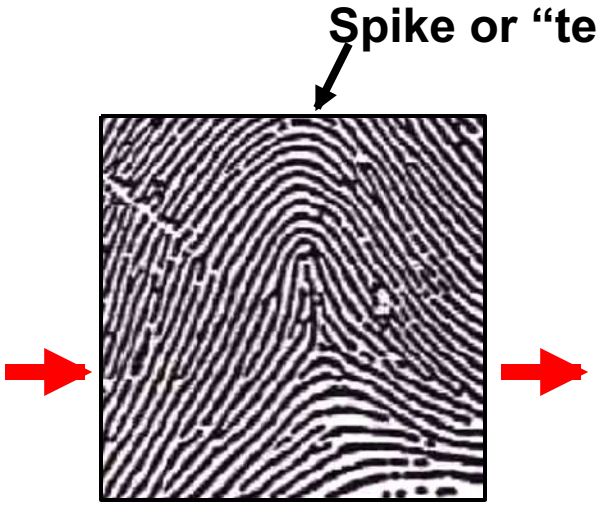


http://forensictrainingunlimited.wordpress.com/2014/01/29/adermatoglyphia-the-genetic-disorder-of-people-born-without-fingerprints-science-smithsonian/

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.

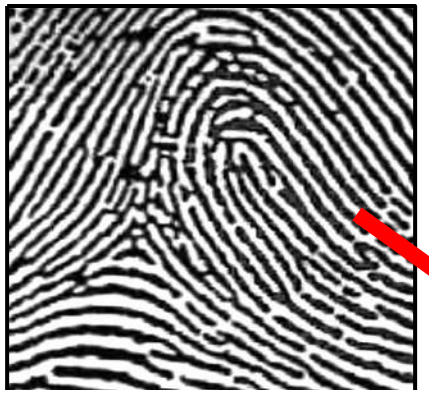
Plain Arch
Ridges enter on one side and exit on the other side.



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

Loops

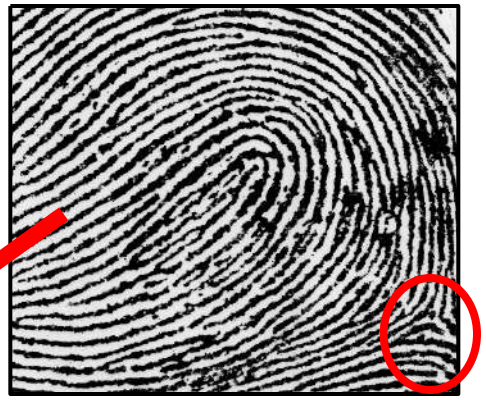
Loops must have one delta and one or more ridges that enter and leave on the same side. These patterns are named for their positions related to the radius and ulna bones.



Ulnar Loop (Right Thumb)

Loop opens toward right or the ulna bone.

Delta



Radial Loop (Right Thumb)

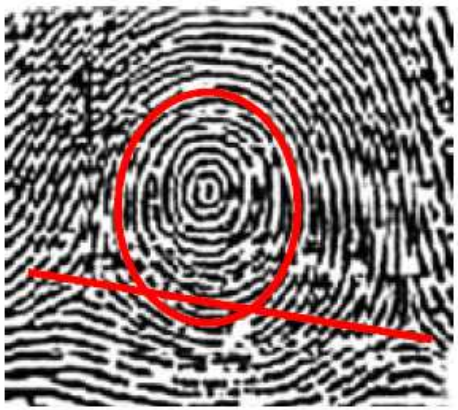
Loop opens toward the left or the radial bone.

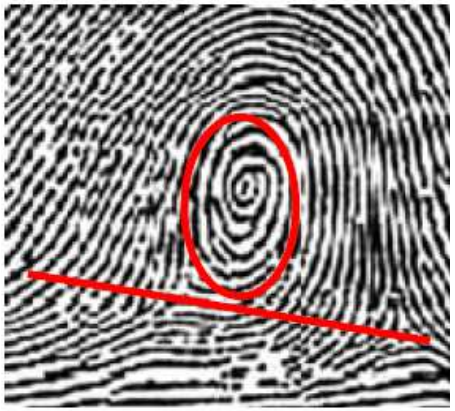
NOTE: On the left hand, a loop that opens to the left would be an ulnar loop, while one that opens to the right would be a radial loop.

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



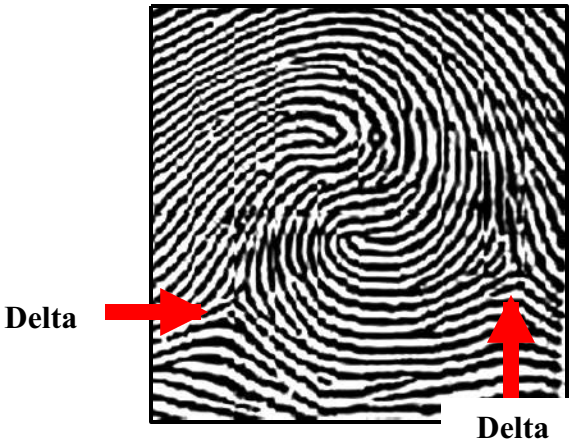


Central Pocket Whorl

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 each fingerprint pattern.

A

Left Hand

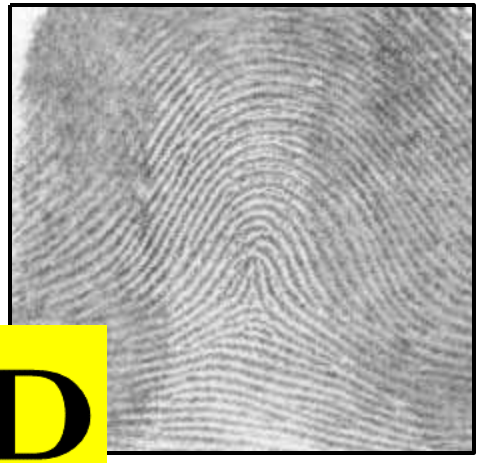
?

B

Right Hand

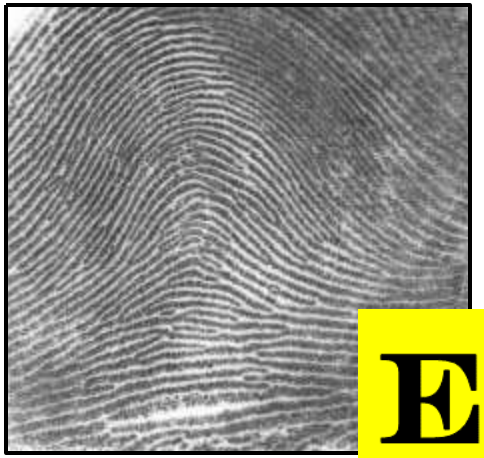
C

Right Hand



D

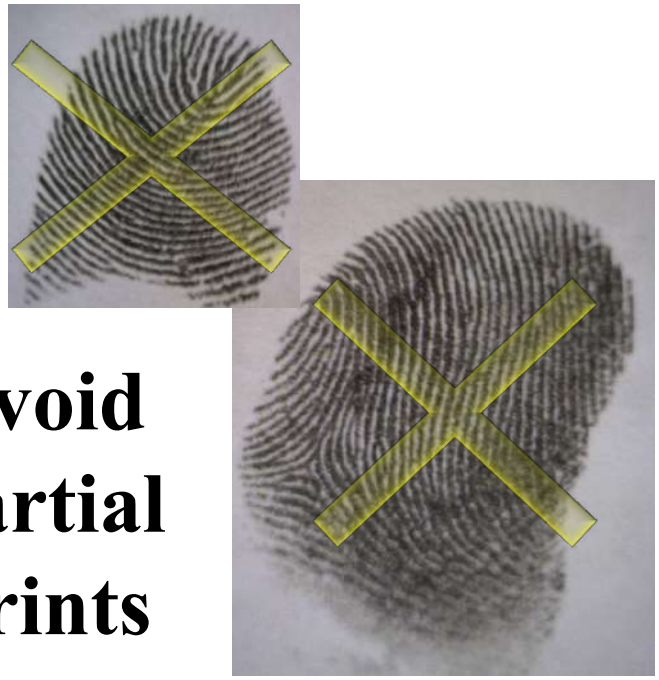
Right Hand



E

Left Hand

It's time to make some prints!



Avoid Partial Prints

GOOD PRINT

Get as much of the top part of your finger as possible!

Directions

1st – Roll the "pad" portion of your thumb over the ink pad from the left side of your thumb to the right. You do not have to push down really hard!

2nd – Roll the "pad" portion of your thumb from the left side of your thumb to the right in the correct box on your paper to make a thumbprint.

3rd – Continue this process to make a fingerprint of all ten fingers on the "My Prints" worksheet.

4th –Use your notes and a magnifying lens to help you figure out what type of pattern is found in each of your fingerprints. Label each one with the pattern's name.

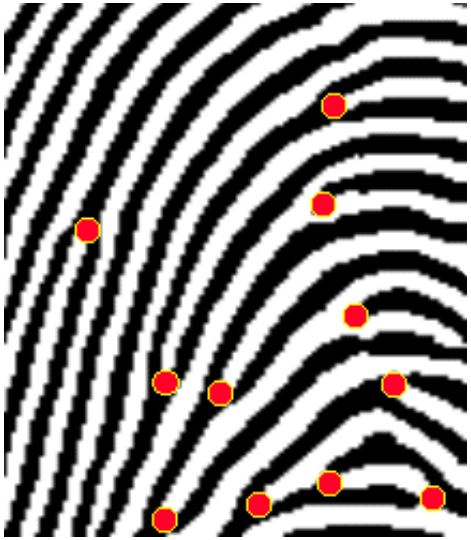
Ridgeology

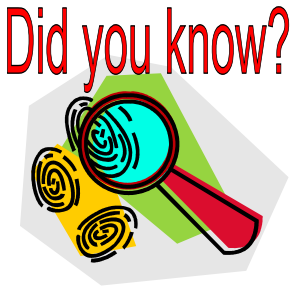
A Closer Look at Fingerprints

Image from ftp://sequoyah.nist.gov/pub/nist_internal_reports/ir_6534.pdf

Ridgeology: The study of the uniqueness of friction **ridge** structures and their use for personal **identification**.[1]

As we have learned in our first lesson, a fingerprint is made of a series of **ridges** and **valleys** on the surface of the finger. The uniqueness of a fingerprint can be determined by the **pattern** of ridges and valleys as well as the **minutiae** points, which are points where the ridge structure changes.





The koala is one of the few mammals (other than primates) that has fingerprints. In fact, koala fingerprints are remarkably similar to human fingerprints; even with an electron microscope, it can be quite difficult to distinguish between the two.

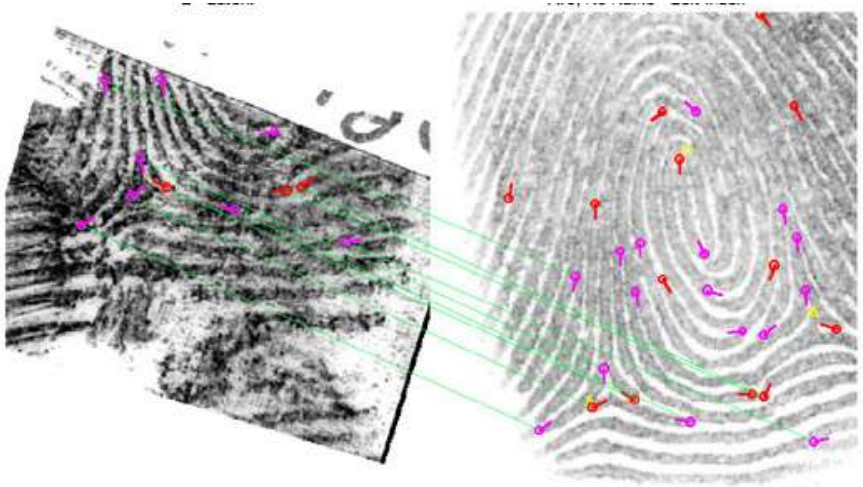
[1] *Introduction to Basic Ridgeology* by David Ashbaugh, May 1999

Image from http://www.cs.usyd.edu.au/~irena/minutia.gif

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. However, the United Kingdom requires a minimum **sixteen** points while Australia requires **twelve**.

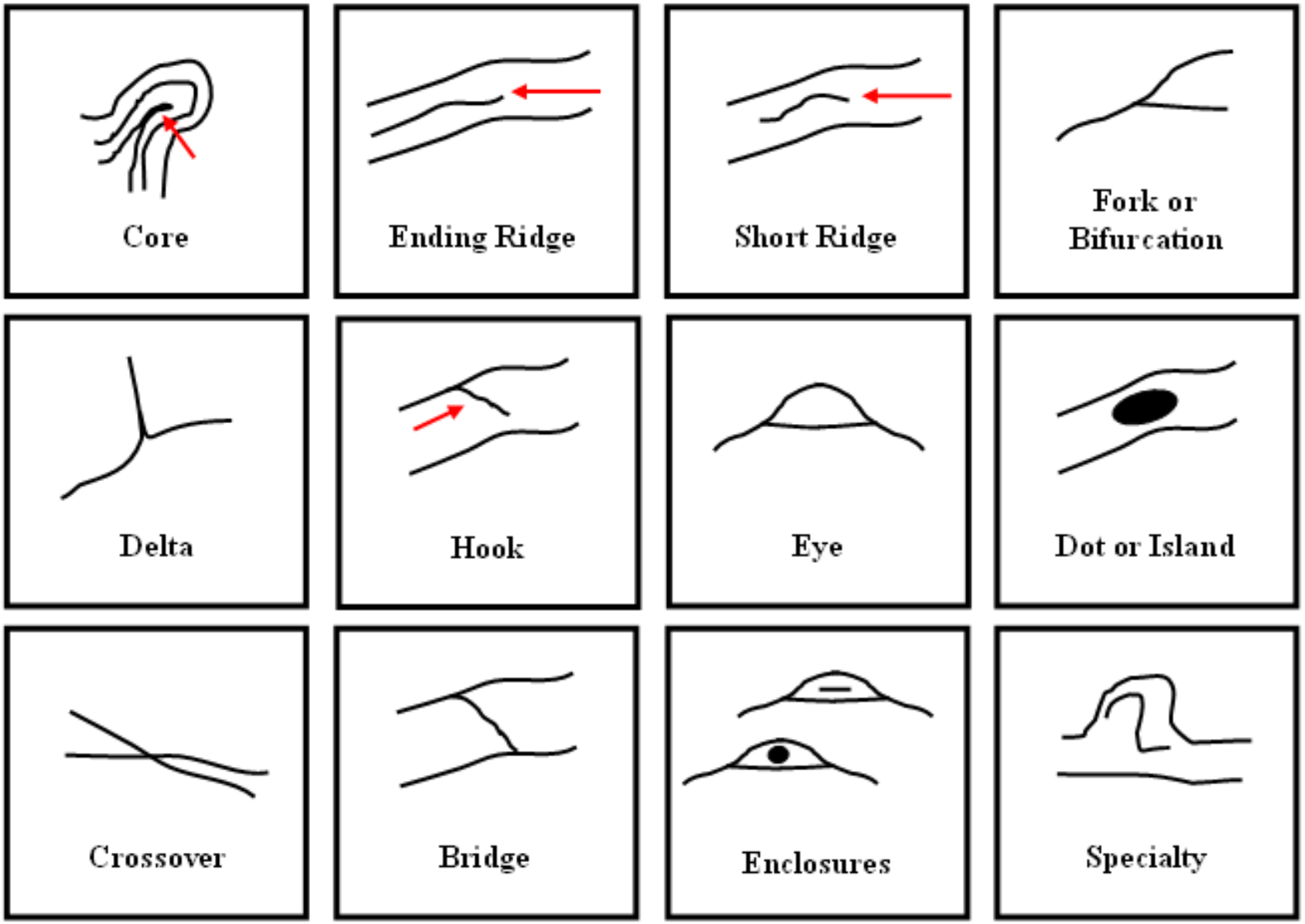
Automated Fingerprint Identification System (AFIS)



http://www.fdle.state.fl.us/CrimeLab/images/fingerrint%20comparison%20for%20afis.jpg

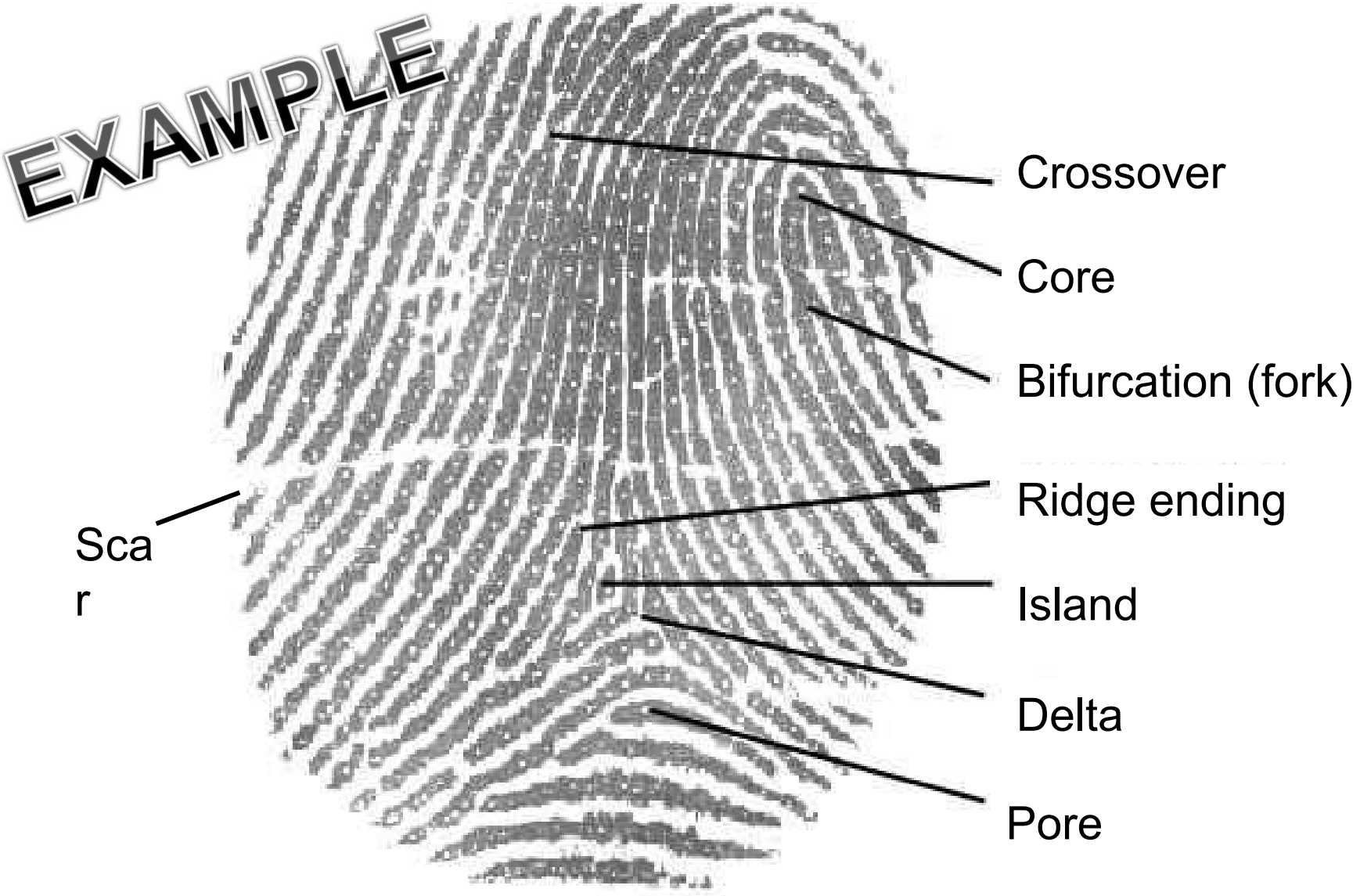
AFIS is a computerized system capable of reading, classifying, matching, and storing fingerprints for criminal justice agencies. Quality latent fingerprints are entered into the AFIS for a search for possible matches against the state maintained databases for fingerprint records to help establish the 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



http://cnx.org/content/m12574/latest/properties.jpg

How many ridge characteristics can you identify in this fingerprint?

http://www.dkfz.de/tbi/projects/bmcv/images/iu_it246_04s_fingerprint1.jpg

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?

Balloon Fingerprint Activity: http://www.msichicago.org/fileadmin/Education/learninglabs/lab_downloads/fingerprint_analysis.pdf

http://www.youtube.com/watch?v=HsRUY6twUX4

http://www.youtube.com/watch?v=dOdPirQQh9Q