


Chapter 4: **Fingerprints**



“Fingerprints can not lie,
but liars can make
fingerprints.”

—Unknown



📌 <http://www.shodor.org/workshops/forensic/lessons/familypic.html>

📌 How many people were involved in the scene?

📌 What can you tell about each individual's hairstyle, gender, approximate age, etc.

📌 Was there anything unusual going on?

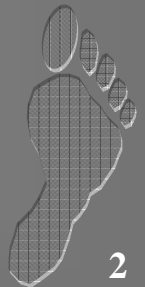


Fingerprints

Students will learn:



- Why fingerprints are individual evidence.
- Why there may be no fingerprint evidence at a crime scene.
- How computers have made personal identification easier.



Fingerprints

Students will be able to:



- Define the three basic properties that allow individual identification by fingerprints.
- Obtain an inked, readable fingerprint for each finger.
- Recognize the general ridge patterns (loops, whorls, and arches)
- Identify friction ridge characteristics and compare two fingerprints with at least ten points of identification.
- Explain the differences among latent, plastic, and visible fingerprints.
- Develop latent prints (make them visible) using physical and chemical methods.



Fingerprints

Recording Prints

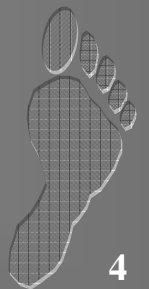
- rolling inked prints
- primary identification number

Lifting Prints

- Black, white and fluorescent powder
- Chemicals—ninhydrin, iodine, silver nitrate, cyanoacrylate

Other Types of Prints

- Palm, lip, teeth, eye, ear, voice, shoe and footprints



Dactyloscopy

The study of fingerprints

Historically

- **William Herschel**—required Indians to put their fingerprints on contracts, and also as a means of identifying prisoners
- **Henry Faulds**—claimed that fingerprints did not change over time and that they could be classified for identification
- **Alphonse Bertillon**—proposed body measurements as a means of identification; termed *anthropometry*
- **Francis Galton**—developed a primary classification scheme based on loops, arches and whorls.
- **Edward Richard Henry**—in collaboration with Galton instituted a numerical classification system
- **Juan Vucetich**—developed a fingerprint classification based on Galton's that is used in Spanish-speaking countries



Fundamental Principles of Fingerprints



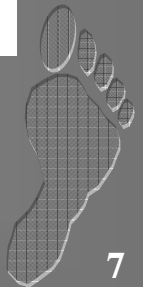
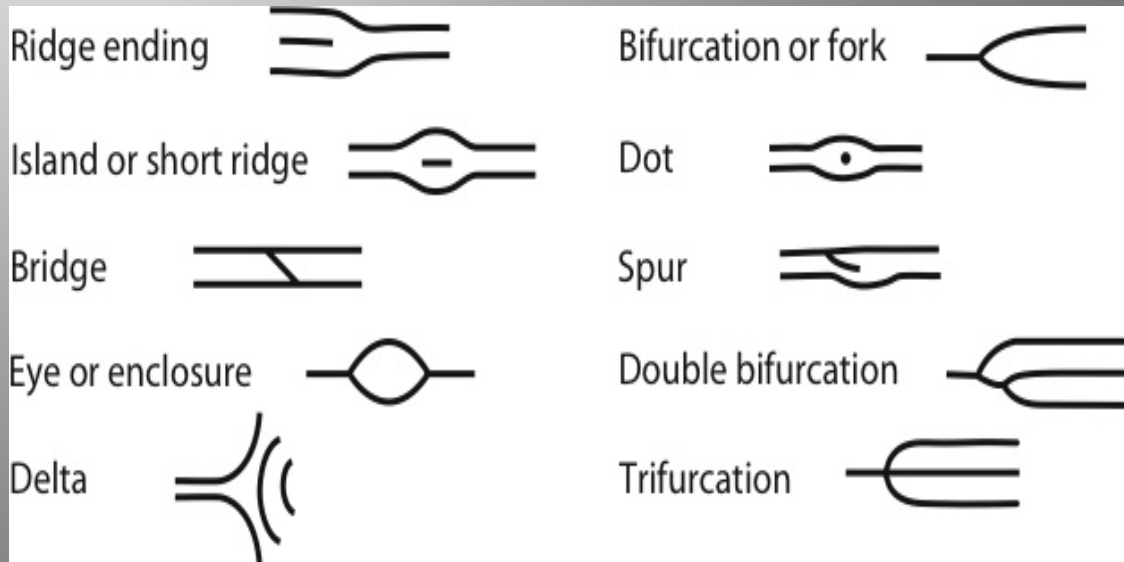
- A fingerprint is an individual characteristic.
- A fingerprint will remain unchanged during an individual's lifetime.
- Fingerprints have general characteristic ridge patterns that permit them to be systematically classified.



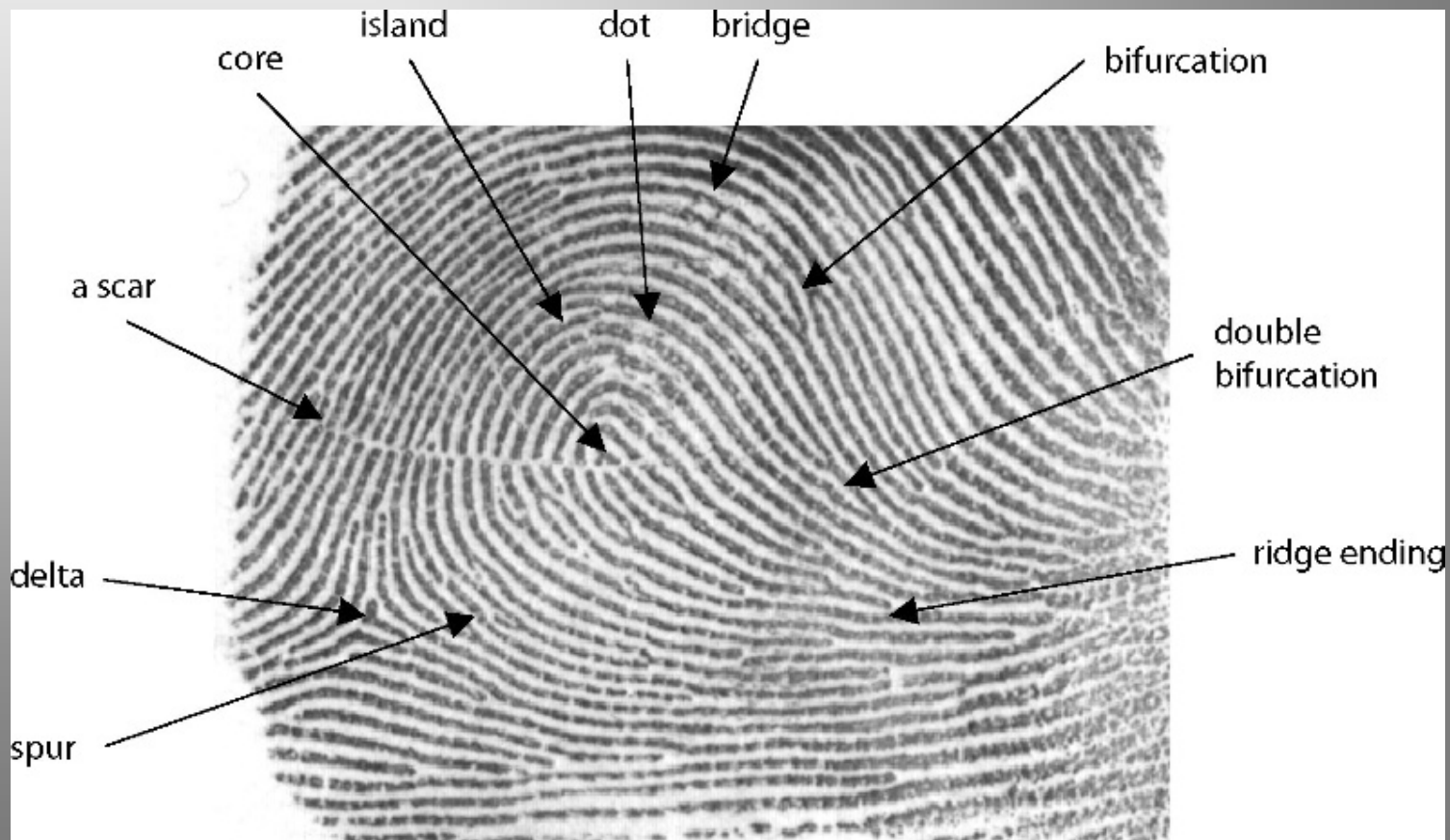
Ridge Characteristics

Minutiae—characteristics of ridge patterns

- Ridge ending
- Short ridge
- Dot or fragment
- Bifurcation
- Double bifurcation
- Trifurcation
- Bridge
- Island
- Enclosure
- Spur



Fingerprint Minutiae



Arch

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.

Types

- Plain
- Tented



Loop



- A loop must have one or more ridges entering and exiting from the same side. Loops must have one delta.
- *Types*
 - **Radial**—opens toward the thumb
 - **Ulnar**—opens toward the “pinky” (little finger)
- Which type of loop is this, if it is on the right hand? Left hand?

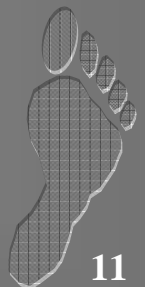


Whorl

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

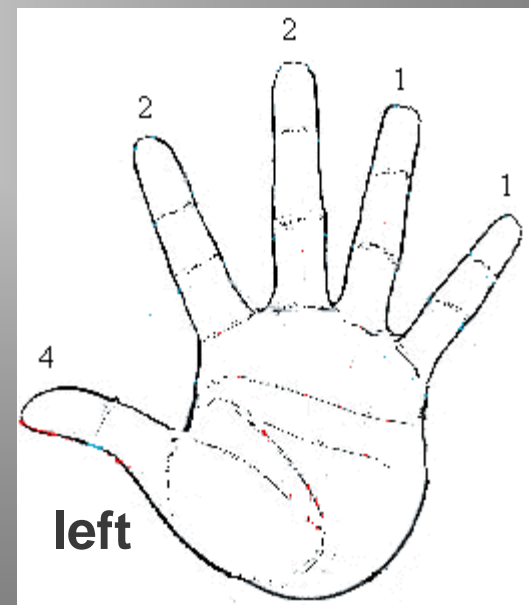
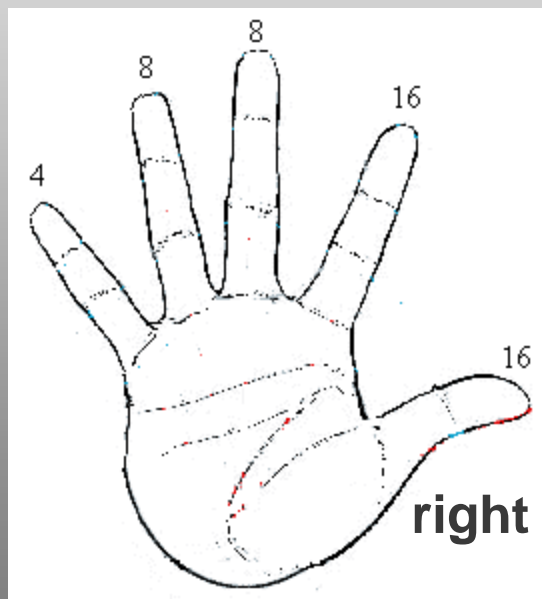
- **Types**

- Plain
- Central Pocket
- Double Loop
- Accidental



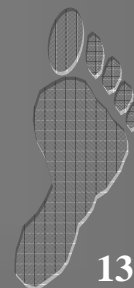
Primary Classification

The Henry—FBI Classification
Each finger is given a point value



How to collect fingerprints

 <http://www.youtube.com/watch?v=D8cQCs1eW8c>



Primary Classification

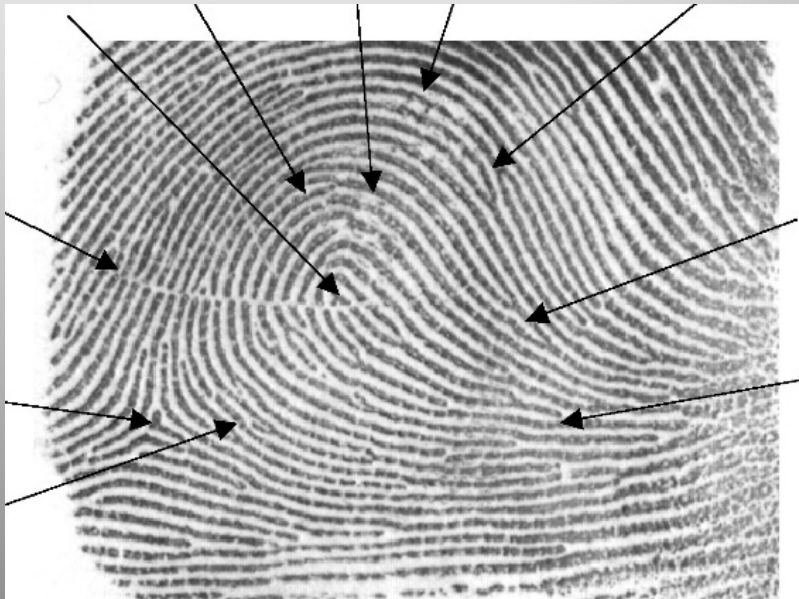
Assign the number of points for each finger that has a whorl and substitute into the equation:

$$\begin{array}{cccccc} \text{right} & \text{right} & \text{left} & \text{left} & \text{left} & \\ \text{index} & \text{ring} & \text{thumb} & \text{middle} & \text{little} & + 1 \\ \hline \text{right} & \text{right} & \text{right} & \text{left} & \text{left} & \\ \text{thumb} & \text{middle} & \text{little} & \text{index} & \text{ring} & + 1 \end{array} =$$

That number is your primary classification number



Comparison



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





 <http://www.youtube.com/watch?v=vob8Os8HHqA&feature=related>



Latent Prints

- 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.
- Most secretions come from three glands:
 - **Eccrine**—largely water with both inorganic (ammonia, chlorides, metal ions, phosphates) and organic compounds (amino acids, lactic acids, urea, sugars). Most important for fingerprints.
 - **Apocrine**—secrete pheromones and other organic materials.
 - **Sebaceous**—secrete fatty or greasy substances.



Developing Latent Prints

- Developing a print requires substances that interact with secretions that cause 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.
 - **Powders**—adhere to both water and fatty deposits. Choose a color to contrast the background.
 - <http://www.youtube.com/watch?v=iRSTpV9aaLc&feature=related>
 - **Iodine**—fumes react with oils and fats to produce a temporary yellow brown reaction.



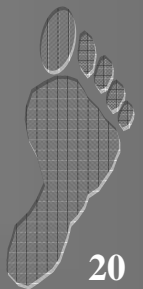
Developing Latent Prints

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

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.



Iodine Fingerprint



Ninhydrin Fingerprint



Cyanoacrylate Fingerprints



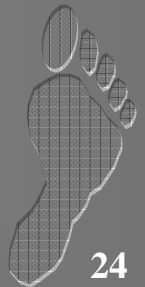


<http://www.youtube.com/watch?v=NjGyil6k75M>



Other Prints

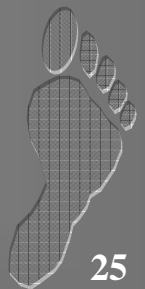
- **Ears**—shape, length and width
- **Voice**—electronic pulses measured on a spectrograph
- **Foot**—size of foot and toes; friction ridges on the foot
- **Shoes**—can be compared and identified by type of shoe, brand, size, year of purchase, and wear pattern.



Other Prints



Palm—friction ridges can be identified and may be used against suspects.



Other Prints

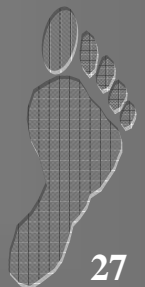
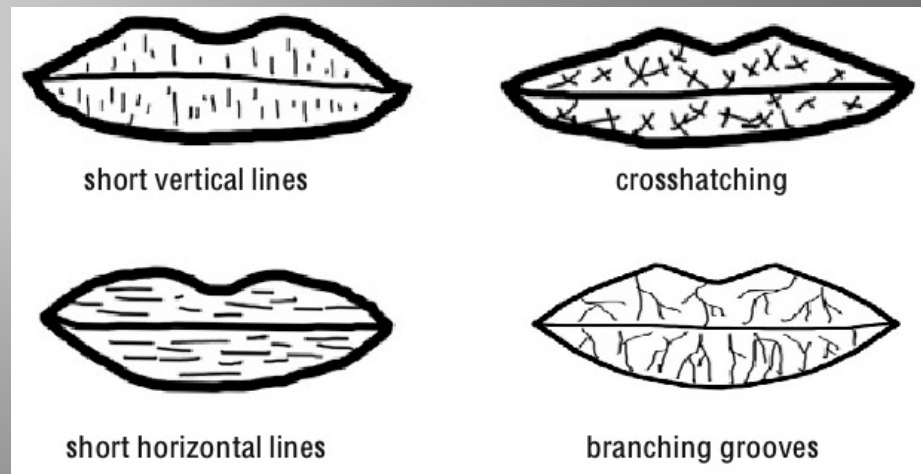
Footprints are taken at birth as a means of identification of infants.



Other Prints

Lips—display several common patterns

- Short vertical lines
- Short horizontal lines
- Crosshatching
- Branching grooves



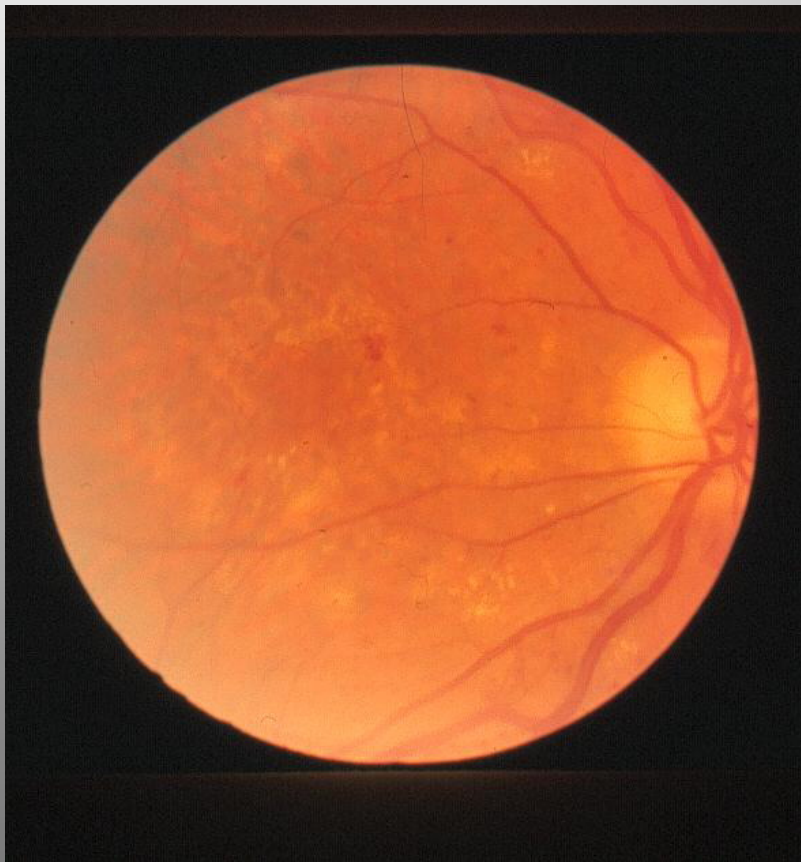
Other Prints



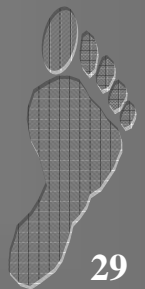
Teeth—bite marks are unique and can be used to identify suspects. These imprints were placed in gum and could be matched to crime scene evidence.



Other Prints

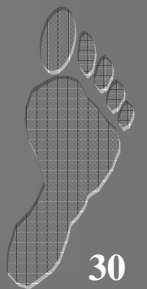


The blood vessel patterns in the eye may be unique to individuals. They are used today for various security purposes.



Brain Fingerprinting

 [http://www.youtube.com/watch?v=REqfGF
KxBzU](http://www.youtube.com/watch?v=REqfGFKxBzU)



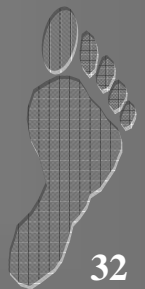
AFIS

- 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 a national database of all 10-print cards from all over the country



Biometrics

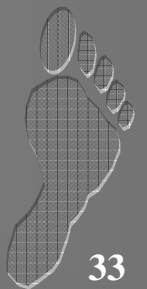
- Use of some type of body metrics for the purpose of identification. (The Bertillon system may actually have been the first biometry system.)
- Used today in conjunction with AFIS
- Examples include retinal or iris patterns, voice recognition, hand geometry
- Other functions for biometrics—can be used to control entry or access to computers or other structures; can identify a person for security purposes; can help prevent identity theft or control social services fraud.



New Technology

🔗 <http://www.youtube.com/watch?v=D1VhSCu1sSE>

🔗 <http://www.youtube.com/watch?v=Hlck-I-S8r8>



More about Prints

For additional information about prints and crime, check out Court TV's Crime Library

www.crimelibrary.com/criminal_mind/forensics/fingerprints/1.html

