

*Handout 4-A*Leave Only Fingerprints:  
Student Lab Investigation

Name \_\_\_\_\_ Date \_\_\_\_\_

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*Your Job*

Make an ink copy of your fingerprints and identify patterns. In teams, make latent (invisible) and visible fingerprints on paper, plastic, or glass. After exchanging mystery prints, use several forensics lab procedures to identify the owners of the prints.

**Part 1: Make and Identify Your Fingerprints**

1. Using scrap paper and a dark-colored ink pad, practice making a fingerprint with a clear pattern. Here's how to do it:
  - a. Line up the edge of a piece of scrap paper with the top edge of the table in front of you. Place the entire first joint of each finger flat on the paper with the rest of your hand hanging off the edge of the table.
  - b. Lightly press the first joint of your thumb on the ink pad.
  - c. Transfer the print by either pressing your thumb straight down onto the paper using two fingers of your other hand and then lifting straight up OR rolling your thumb from the left edge to the right edge using your other hand for guidance. You can also work in pairs to assist each other.
  
2. Get a fingerprint card (Handout 4-B) from your teacher. You will make a set of clear fingerprints of both hands. Here's how to do it:
  - a. Fold the paper under the top row of fingerprint boxes. These boxes now sit at the bottom of the visible page. Place this row of boxes on the edge of the table in front of you.
  - b. Use the ink pad to make a set of fingerprints on the fingerprint card for one hand. After getting teacher approval of your prints, wash your hand.
  - c. Refold the fingerprint card under the second row of boxes.
  - d. Make a set of fingerprints for the second hand. After getting teacher-approval of your prints, wash your hand.
  
3. Read "Identifying Fingerprints" (Handout 4-C) and answer the "What Does It Mean?" questions at the end. Look at your own prints while reading. Use the "Fingerprint Pattern Key" in Handout 4-C, pp. 96–99, and magnifying lens to identify the patterns for each finger. Write the pattern below each print on your card.

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**Part 2: Prepare Mystery Fingerprint Evidence**

1. Get a tray of required materials (rubber surgical gloves; 3" × 5" white and colored paper; and small, fingerprint-free objects that your teacher will provide) for your group of four.
2. Place the fingerprint cards for all your group members in the bottom of the tray.
3. Pick two group members to create visible ink print evidence on paper (#4 below) and two members to create latent oil print evidence on glass, plastic, or cardboard (#5 below).
4. To create *visible ink* fingerprint evidence:
  - a. One person make ink prints of your thumb and pointer finger from either hand on a piece of 3" × 5" paper. Label it "Evidence 1."
  - b. The second person makes ink prints of your thumb and pointer finger from either hand on a second 3" × 5" paper. Label it "Evidence 2."
  - c. Place the mystery prints in the tray.
5. To create *latent oil* fingerprint evidence:
  - a. Your teacher will tell you which forensic lab techniques (dusting powder, superglue, or iodine crystals) you will be using. If you will be using the dusting powder technique, make your prints on a glass jar or plastic piece. If you will be using the superglue technique or the iodine crystals technique, you can use glass or plastic microscope slides OR paper or cardboard pieces that fit into the fuming jars.
  - b. Put a latex glove on one hand before touching the objects. Pick up a clean object with your gloved hand. Hold only the edge. Mark each object as "Evidence #3" or "Evidence #4."
  - c. Wipe the fingers of your other hand across your forehead or along the sides of your nose to coat them with body oil.
  - d. Carefully press the first joints of your thumb and first two fingers straight down onto the object. Then lift them straight up.
  - e. Place the object in the tray using only your gloved hand.
  - f. On a separate piece of paper, record whose prints are on Evidence #1, #2, #3, and #4. Give your key to the teacher.



*Handout 4-A***Leave Only Fingerprints:  
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Your teacher will let you know which forensic lab techniques (dusting powder, superglue, or iodine crystals) you will be using to make the latent prints visible.

1. Exchange your tray of evidence with another group and form two pairs within your group.
2. Each pair chooses a visible ink print and a latent oil print to identify.
3. Use a magnifying lens to compare the visible ink prints to the fingerprint cards.
4. Identify the owner of the print.
5. Follow the technique, specified by your teacher, for making prints visible with dusting powder, superglue, or iodine crystals.
6. Use a magnifying lens to compare the print to the fingerprint cards.
7. Identify the owner of the print.
8. Check the accuracy of your results by getting the group's key from the teacher.

***If You Are Using the Dusting Powder Technique, You Will Need:***

- Butcher paper to cover table
- Fingerprint powder or baby powder
- Fine, soft, and thick cosmetic powder brushes
- Clear 1"-2" cellophane tape or packing tape
- 3" × 5" paper (contrasting color to powder)
- Evidence: glass jar or plastic object (contrasting color to dust)

***Procedure***

1. Working in pairs, have one person put on a plastic glove and pick up the glass or plastic evidence. Tear off a piece of clear tape that is long enough to hold onto the edges and still cover the print. Be careful to not

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add your fingerprints to the center of tape. Hang tape from the edge of the table to use later.

2. Lightly touch the tips of the brush in the powder and tap off the excess.
3. Lightly dust the glass item in a circular motion until the print becomes visible. The powder will stick to the oily grooves of the print. Be careful not to drown the print with too much powder.
4. While one person holds the evidence, the partner needs to attach one edge of the tape beyond one side of the print and roll the tape over the print, being careful not to make creases or air bubbles. Then he or she slowly pulls off the tape with the transferred print.
5. Tape the lifted prints onto paper that is different from the powder color. Identify the print pattern and owner.

***If You Are Using the Superglue (Cynanoacrylate) Technique, You Will Need:***

- Superglue tube
- Aluminum foil
- Airtight glass jars
- Tweezers or surgical gloves
- Weak heating source (lamp, coffee cup warmer, hot plate)
- Surgical gloves
- Evidence: Glass or plastic microscope slides OR paper or cardboard pieces that can fit into fuming jar.

***Procedure***

1. Blow into the empty fuming jar to add humidity to the air.
2. Work under a fume hood or in a ventilated area. Put a drop of superglue on a small piece of aluminum foil. Use tweezers or surgical gloves to put the foil in the bottom of the fuming jar.
3. Carefully put the fingerprinted evidence in the jar so that it does not touch the superglue.



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4. Close the lid tightly and place the jar by a warm lamp or on a hot plate set on "low."
5. Let the fumes from the superglue react with the print for 5–10 minutes. If the print is not visible, add either more heat or another drop of superglue and let sit for another 5 minutes. If you use too much superglue or leave the print for too long, a layer of white will hide the fingerprint.
6. When the print is visible, remove the evidence from the fuming jar and identify the owner.

***If You Are Using the Iodine Crystals Technique, You Will Need:***

- Airtight jar with small amount of iodine crystals
- Tweezers or surgical gloves
- Evidence: Glass or plastic microscope slides OR paper or cardboard pieces that can fit into fuming jar.

***Procedure***

1. Pick up the fingerprinted evidence with tweezers or surgical gloves. If the evidence is flat paper or plastic and will be hard to get out of the fuming jar, attach it to a paper clip on a string.
2. Work under the fume hood or in a ventilated area. Quickly open the fuming jar containing a few iodine crystals and put the prints in the jar. Let the string hang over the opening onto the outside of the jar. Close the jar tightly.
3. Let the iodine fumes develop the prints for about 15 minutes.
4. Under the fume hood or in a ventilated area, open the jar, remove the print, and immediately close the jar tightly. Identify the owner.

*Handout A-B*  
Fingerprint Card

Name \_\_\_\_\_ Date \_\_\_\_\_

**Right Hand**

Thumb	1st Finger	2nd Finger	3rd Finger	4th Finger

Classification of Print Patterns:

\_\_\_\_\_

**Left Hand**

Thumb	1st Finger	2nd Finger	3rd Finger	4th Finger

Classification of Print Patterns:

\_\_\_\_\_

Prints taken by: \_\_\_\_\_

# *Handout A-C* Identifying Fingerprints

Name \_\_\_\_\_ Date \_\_\_\_\_

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Why is the search for fingerprints at the scene of a crime so important? It's because each person on the planet has a unique set of prints, different from that of the other billions of people. Even identical twins have different fingerprint patterns. A fingerprint can prove that a certain person was at the place of the crime or touched something that was used in a crime.

Juan Vucetich, a Coatian-born Argentine anthropologist and police official, pioneered the use of fingerprinting in criminal investigations over 100 years ago. In 1891 Vucetich began the first filing of fingerprints based on ideas of Francis Galton, ideas that he expanded significantly. In 1892, Vucetich made the first positive identification of a criminal through the use of fingerprints. Two children had been murdered and their mother had received several knife wounds, but survived. She accused a male acquaintance of the crime, but a bloody fingerprint discovered at the scene proved to be a match to the mother. Faced with the evidence, she confessed and was convicted of the crime (NLB 2006). Argentine police adopted Vucetich's method of fingerprinting, and it spread to police forces all over the world.

In 1902, Dr. Henry P. DeForrest pioneered the use of fingerprinting in the United States. DeForrest led the campaign to systematically fingerprint all candidates taking the civil service exam for the New York Civil Service Commission. This action ended the practice of paying someone to take the exam in the real candidate's place. The following year, the New York State Prison System began fingerprinting all of its inmates, and in 1904 the International Association of Chiefs of Police created the first national fingerprint collection site, the National Bureau of Criminal Identification (Sellin 1971). Today the FBI keeps a computerized database of over 49 million sets of fingerprints for criminals, civilians, military personnel, and government employees.

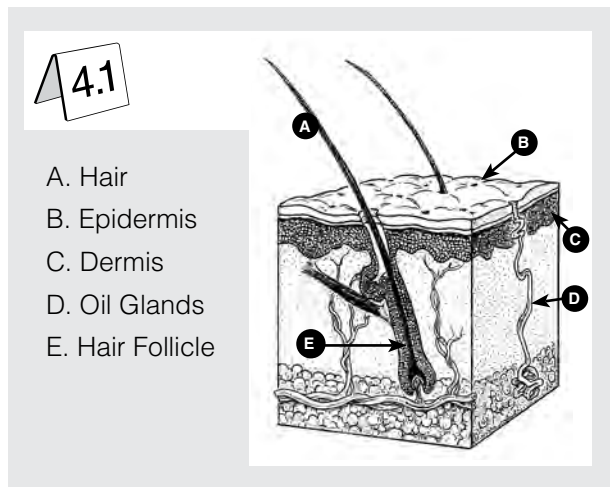
## *What Does the Forensic Scientist Need to Know?*

To analyze fingerprint evidence, a forensic scientist must understand the anatomy of fingerprints and be able to distinguish among the many fingerprint patterns. He or she must also be able to choose and conduct the most appropriate lab technique to make a latent (invisible) print visible.

# Handout 4-C Identifying Fingerprints

## What Is a Fingerprint?

A fingertip has small ridges and grooves that create a unique pattern. The purpose of the ridges is to create friction between the fingertips and the object being touched.



4.1

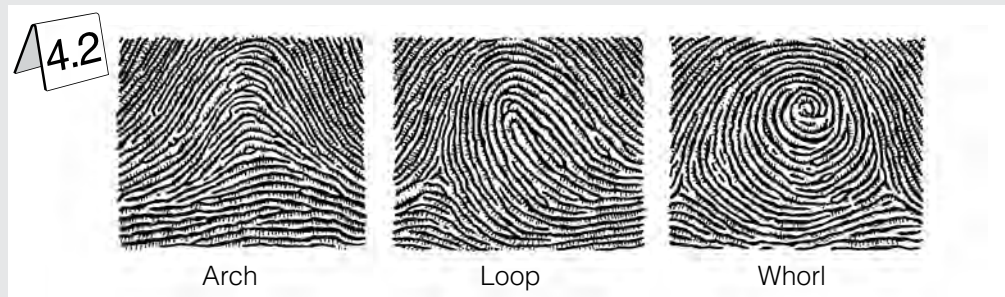
- A. Hair
- B. Epidermis
- C. Dermis
- D. Oil Glands
- E. Hair Follicle

The skin is made of two layers (see Figure 4.1). The outer epidermis is worn off and replaced throughout a lifetime. The inner dermis holds oil and sweat glands that keep the skin moist. This oil pools in the grooves between the friction ridges. When a finger touches an object, the oil transfers the pattern onto the object. This oil print can be matched to a finger, and to the person who made it.

The ridge pattern forms during early fetal development and never changes. In the past, people have tried unsuccessfully to remove their fingerprints, but because the ridges are in deep layers of the skin, permanent removal of them would deform and damage the use of the hands.

## Fingerprint Pattern Key

There are eight fingerprint patterns: plain arch, tented arch, radial loops, ulnar loops, plain whorl, central pocket whorl, double loop whorl, and accidental whorl. These patterns fall into three groups: arches, loops, and whorls (Figure 4.2).



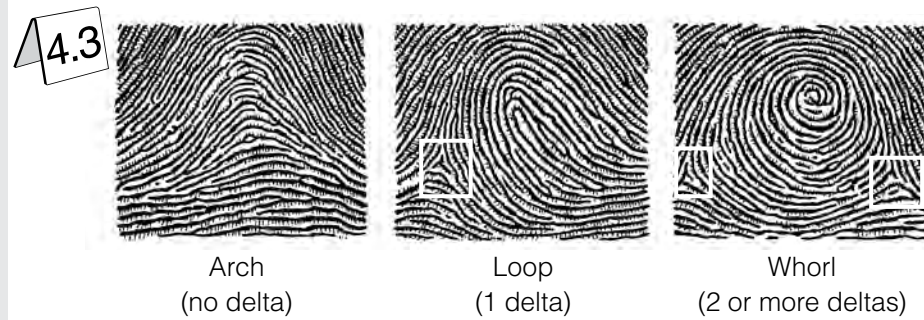
4.2

Each group has a different number of *deltas*, the place where ridges converge from three sides to form a triangle shape. Arches have no deltas, loops have one, and whorls have two (Figure 4.3).



# Handout A-C

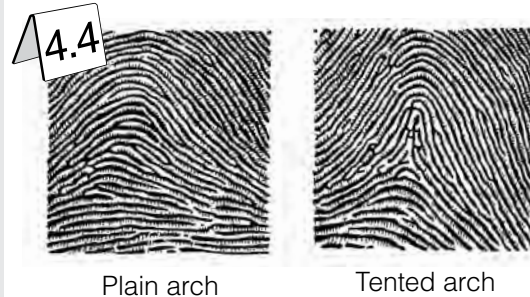
## Identifying Fingerprints



### Arches

Arches are the simplest patterns and have no deltas. The ridges enter from one side of the finger and exit on the opposite side (Figure 4.4).

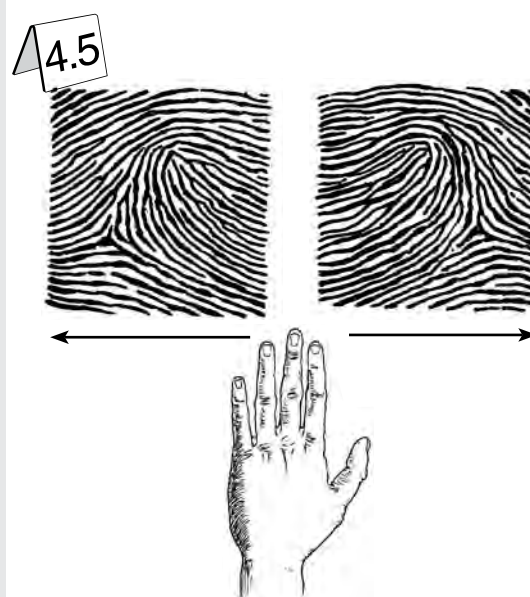
- Plain Arch—A plain arch moves across the finger with no center point (core) or intersecting ridges.
- Tented Arch—The center core of the tented arch looks like a vertical pole holding up a tent, sometimes mistaken for a delta.



### Loops

Loops are the most common print pattern. A loop has ridges that enter and exit from the same side of the finger. It has one delta on the other side.

If you know which hand the print was taken from, you can classify it as a *radial loop* or an *ulnar loop*. Place your right hand palm-down next to the loops in Figure 4.5. If the loop goes toward your little



## Handout 4-C Identifying Fingerprints

finger (and ulnar bone), it is an ulnar loop. If the loop goes toward your thumb (and radial bone), it is a radial loop. Now place your left hand on the paper. The ulnar loop becomes a radial loop, and vice versa.

### Whorls

The center of a whorl looks like a circle, or the ridges move in a circular direction. Most whorls have two deltas, though some may have more. There are four different types of whorls (Figure 4.6).

- Plain Whorl—The center ridges form a circle, with larger circles moving out from it like rings on a lake after a rock breaks the surface of water. If an imaginary line were drawn between the two deltas, it would cut across those rings.
- Central Pocket Whorl—The center circle of ridges is there, but very small. The outer ridges move to one side of the pattern, causing it to look like a loop. It has two deltas, but the imaginary connecting line does not cross the center circles.
- Double Loop Whorl—This whorl is actually two separate loops wrapped together in the center of the print. They have separate shoulders and two deltas.
- Accidental Whorl—This uncommon whorl is a combination of different loop and whorl patterns. It usually has more than two deltas.



### What Types of Fingerprint Evidence Are There?

There are three types of fingerprint evidence: latent prints, visible prints, and plastic impressions. These types describe the surface the print was made on and how the print was made.

- A *latent print* is a mark left on a surface from the finger's natural oil. This type of print is not clearly visible until another material touches

## *Handout A-C* Identifying Fingerprints

or reacts with the oils. The most common method to make a latent print visible is to dust it with powder that attaches to the oils left on the surface. Iodine crystals and superglue both cause chemical reactions with the oils that make the latent print visible. Law enforcement agencies can now use computers to digitally scan a hand or fingertips.

- A *visible print* can be seen without any additional help from other materials. It is made when a fingertip—covered with paint, ink, oil, dirt, cream, or other colored substance—touches another surface and leaves a mark.
- *Plastic impressions* are three-dimensional prints made when a finger is pressed into a soft material that holds its shape. Impressions can be made in clay, putty, grease, wet paint, or soft wax.

### *What Did You Discover About Fingerprinting?*

1. Explain one of several reasons people began collecting and identifying fingerprints.
2. Describe or draw the anatomy of a fingerprint using the following terminology: *ridge, groove, oil, dermis, sweat gland*.
3. What makes a fingerprint unique?
4. How do deltas help identify a print?
5. What is the most common fingerprint pattern?
6. What are the differences among latent, visible, and three-dimensional fingerprints?
7. What lab technique(s) did you use to make latent prints visible? What worked well and what would you do differently next time?
8. Read your comments on fingerprints in your Investigator Notebook (*What do I know about fingerprints? What do I want to know about fingerprints?*). Respond to the following question: *What have I learned about fingerprints?*

*Handout A-C*  
Identifying Fingerprints

STUDENTS: TAKE A CLOSER LOOK



- Will waxing fingertips or fingertip surgery remove or mask a person's fingerprints? Justify your answer.
- What can investigators conclude when fingerprints at a crime scene are matched to a specific individual?
- Why are fingerprints more effective than many other types of evidence at supporting a person's innocence or guilt in a crime?

REFERENCES



Sellin, J. T. 1971. *The police and the crime problem*. New York: Arno Press.

Wikipedia. n.s. [http://en.wikipedia.org/wiki/Juan\\_Vucetich](http://en.wikipedia.org/wiki/Juan_Vucetich)