

Fingerprints

Reading Preview

Key Concepts

- What patterns are used to describe fingerprints?
- What methods are used to collect latent prints?
- How do examiners analyze the prints found at a crime scene?

Key Terms

- ridge
- visible print
- plastic print
- latent print

Target Reading Skill

Asking Questions Before you read, preview the red headings in this section. In a graphic organizer like the one below, ask a *what* or *how* question about each heading. As you read, write the answers to your questions.

Fingerprints

Q. How are fingerprints described?

A. Ridge line patterns are used to describe fingerprints.

Q.

Discover Activity

What Can You See on a Fingertip?

1. Choose a fingertip on the hand that you do not write with. Use a washable marker to color this fingertip. Wipe off any extra ink with a facial tissue.
2. Use a hand lens to observe the colored fingertip.
3. Make a drawing of what you see.
4. When you are done, use soap and water to wash off the ink.

Think It Over

Developing Hypotheses Based on your observations, what do you think produces the lines on a fingertip?

John Dillinger was desperate. It was 1934, and the bank robber was the most wanted criminal in the United States. The FBI had named him Public Enemy Number One. Police officers in every city were looking for him. What could Dillinger do to avoid being caught?

Dillinger asked a doctor to burn his fingertips with acid. He hoped the acid would destroy the evidence that could tie him to many crimes—the patterns on his fingertips. But he was wrong. As his burned skin was replaced by new skin, he could still see patterns on his fingertips.

Your fingerprints are yours for your lifetime. They do not change because your fingertips do not change. The patterns you see on your skin were well developed before you were born. They just got larger as your hands grew. These patterns are part of what makes you a unique human being. No two people, not even identical twins, have the same fingerprints.

WANTED



JOHN HERBERT DILLINGER

On June 12, 1934, JOHN B. STUBBS, Attorney General of the United States, under the authority vested in him by an Act of Congress approved June 8, 1933, offered a reward of




\$10,000.00

for the capture of John Herbert Dillinger and a reward of

\$5,000.00

for information leading to the arrest of John Herbert Dillinger.

REPRODUCTION
 100% (10 cents) 200% (20 cents) 300% (30 cents) 400% (40 cents) 500% (50 cents) 600% (60 cents) 700% (70 cents) 800% (80 cents) 900% (90 cents) 1000% (1.00 dollar)

Fingerprint Patterns		
<p>Loop</p> 	<p>Whorl</p> 	<p>Arch</p> 
<p>The ridge lines start on one side and curve back into loops, like the bend in a river.</p>	<p>In this pattern, the lines form a circle around a central point.</p>	<p>In this pattern, there is a series of curved lines, one above the other.</p>

Describing Fingerprints

For thousands of years, people have known that fingerprints could be used to identify a person. In ancient China, for example, people could sign a legal paper with a thumbprint. Over time, signatures replaced fingerprints as a form of identification. But not in a crime lab.

When you take a close look at your fingertips, you can see a series of raised lines, or **ridges**. These ridges make it easier for your fingers and thumb to grasp and hold on to objects. The ridges also make the lines that you see on your fingerprints. **There are three typical patterns of ridge lines—loops, whorls, and arches.** Figure 1 compares these patterns.

Print examiners look for more than the overall pattern of a print. They look for the details that make the print unique. There may, for example, be places where a ridge ends. Or there may be places where a single ridge splits into two ridges, like a fork in a road. A fingerprint may have as many as 150 specific details.

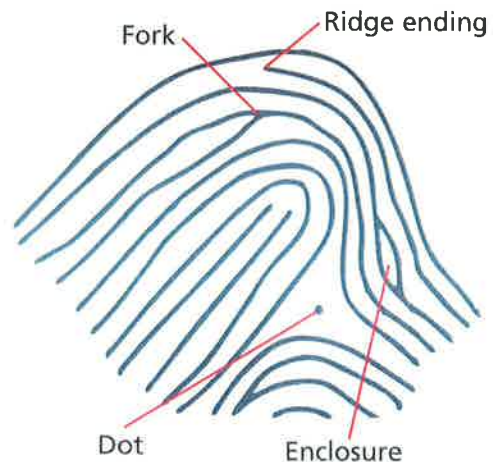


FIGURE 1

Fingerprint Patterns

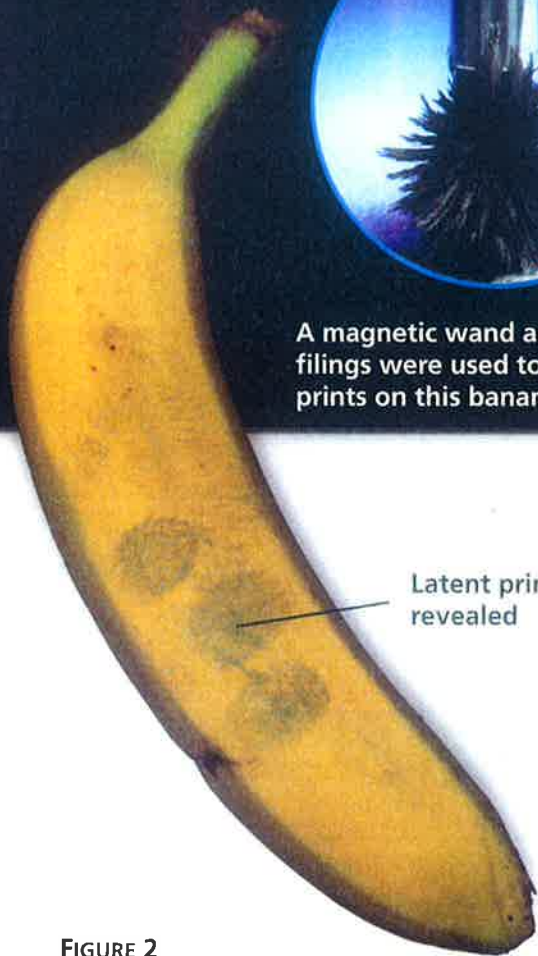
Of the three patterns, loops are the most common and arches are the least common. Only about five percent of people have prints with arches.

Observing Look at the drawing with some details labeled. On a fingerprint, what is a fork? What is an enclosure?



Reading
Checkpoint

What are ridges?



A magnetic wand and iron filings were used to reveal prints on this banana.

Latent print revealed

FIGURE 2
Revealing Latent Prints

There are several ways to reveal latent prints. A CSI often begins by dusting with a fine powder or with iron filings. He may also use chemicals or lighting.

Problem Solving *Would you use a light or a dark powder to dust for latent prints on a glass surface? Explain your answer.*

Discovery
EDUCATION™

Forensic Science Video

Fingerprint Evidence

Dusting with a fine powder works well on glass, tile, or painted wood.



Collecting Fingerprints

Fingerprints left at a crime scene are rarely complete or clear. Sometimes they cannot even be seen. A CSI may find visible, plastic, and latent prints at a crime scene.

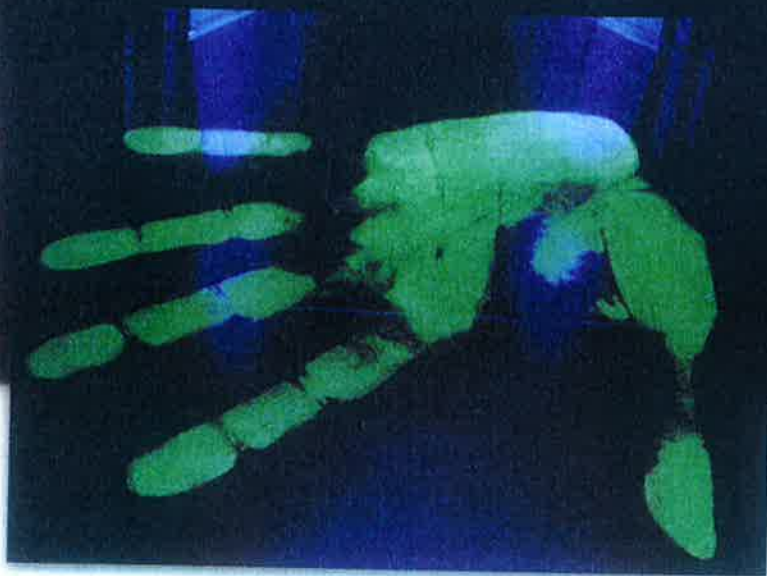
- ▶ If you touch a colored material and press your finger on a surface, you will leave a **visible print**, a print that can be seen. Blood, paint, and ink leave visible prints.
- ▶ If you touch a soft material, such as wax or dust, you will leave an impression, or **plastic print**. Plastic means “able to be shaped.” A CSI can take photographs or make casts of plastic prints.
- ▶ When you transfer sweat or oil from the ridges on your fingers to the surface of an object, you leave a **latent print** (LAY tent). The word *latent* means “hidden.”

Methods that are used to reveal and improve latent prints include dusting, chemical reactions, and lighting. Some methods can be used at the crime scene. Others must be done at the crime lab.

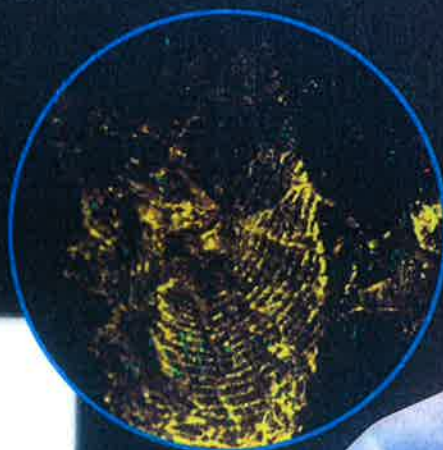
Dusting Figure 2 shows a CSI trying to reveal latent prints. He uses a soft brush to dust a surface with a fine powder. The powder clings to the ridge patterns left by oil and sweat. A CSI chooses a color that allows the print to stand out. On a dark surface, a CSI might use a gray powder.

It isn't practical to dust every surface at a crime scene. So the CSI dusts only surfaces that a suspect may have touched.

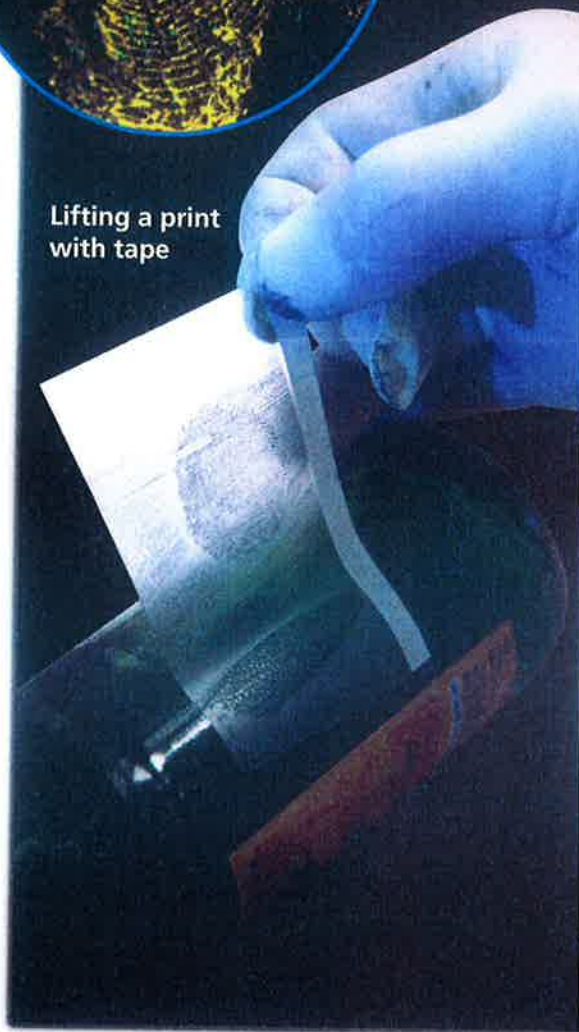
Handprint exposed to ultraviolet light



This print on crumpled aluminum foil was first fumed with glue and then stained with a dye that glows.



Lifting a print with tape



Chemical Reactions Most dusting powders don't work on paper or cardboard. These materials have tiny holes, or pores, that can absorb sweat and oil. The term used to describe such surfaces is *porous* (PAWR us).

For an object with a porous surface, a CSI might use a chemical that reacts with the chemicals in sweat. The CSI sprays the chemical on the object. When the object is warmed, the latent prints become visible.

In a lab, scientists can use the vapor produced when a liquid or solid is heated to reveal latent prints. This method is called fuming. Vapor from a type of glue can reveal prints on metal, plastic bags, and leather objects, such as wallets.

Lighting When you hold a drinking glass up to the light, you may see fingerprints on the glass. A forensic photographer can use a beam of white light to make prints stand out. Some dusting powders produce prints that glow when they are exposed to ultraviolet (UV) light. Prints produced by fuming with glue may be dyed so that they glow, too. That approach was used for the print on aluminum foil shown in Figure 2.

Lifting Prints Once a print is visible, a CSI uses transparent tape to “lift,” or remove, the print from a surface. It is placed on a card with a contrasting color, such as a white card for black powder. The tape must be sticky enough to lift the print but not so sticky that it can't be peeled off the surface.



What is a porous surface?



FIGURE 3
Scanning Fingerprints
A camera in this scanner takes a picture of a fingertip that is pressed against the glass. The image is stored and viewed on a computer.

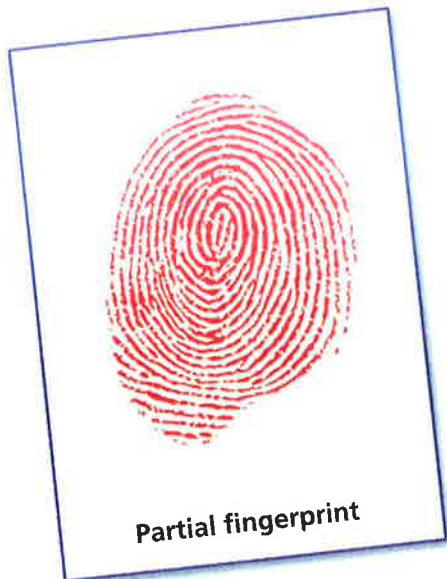


FIGURE 4
Comparing Prints
An examiner uses fine details and small variations to compare prints.
Identifying Which print is the best match for the partial print, and why?

Identifying Fingerprints

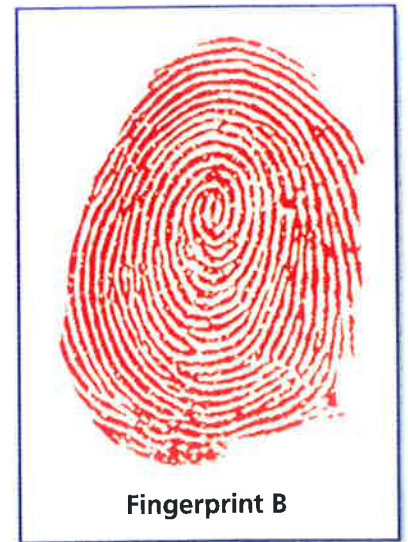
A crime scene is likely to contain many more prints than those of the person who did the crime. **Fingerprint examiners first try to eliminate some prints. Then they try to match the remaining prints with those of a suspect or with prints in a database.**

Eliminating Prints Remember the stamp collection that was stolen from the desk drawer? Fingerprints that were found on the drawer might belong to the owner of the stamps. Police would collect prints from the owner to compare them to the prints on the drawer. If there is a match, an examiner can eliminate those prints as evidence.

After a theft at a museum, police would take prints from the staff and security guards. These workers might have touched a doorknob or a picture frame while doing their jobs. At some crime scenes, police may collect prints from witnesses or the people who were first to respond to the scene.

Taking Prints From a Person For years, police used an ink pad to take fingerprints. Each finger was inked and rolled onto the correct place on a fingerprint card. Now some police departments use a scanner like the one in Figure 3.

Analyzing Prints When an examiner compares two prints, she does three levels of review. She looks at the ridge patterns. Do the prints have loops, whorls, or arches? Then she looks for details such as places where a ridge ends or splits. Finally, she looks for small variations, such as a difference in the width of ridge lines. Try these steps with the prints in Figure 4.



Computer Identification Systems Identifying fingerprints takes a great deal of skill, experience, and time. Computers can now help to sort and match prints. These systems are automated fingerprint identification systems (AFIS). The computer does the sorting. It compares prints from a suspect with prints stored in a database. Then it makes up a list of the most likely matches. The computer has done its part. Now it is time for the print examiner to review the prints. She will decide whether any of the prints is a good match for the suspect's prints.

With an automated system, local police and sheriffs have much more data. Suppose police have prints from a crime scene but no suspect. They can search for a suspect in state and federal databases. The FBI, for example, has the largest collection of fingerprints in the world. The FBI's system can make up to 85,000 searches in a day.

Using AFIS also saves time. Police in Los Angeles were looking for a man who had killed at least 13 people. They found his print in a stolen car. At the time, the city of Los Angeles had 1.7 million fingerprints on file. If a person had searched through all the prints by hand, it might have taken 67 years. But AFIS took only three minutes to match the print.


Skills Activity

Classifying

Your teacher will give you a sheet of fingerprints.

1. Look at the ridge patterns of the fingerprints.
2. Use these patterns to divide the fingerprints into three groups.
3. Examine all the prints in your largest group. Circle one detail on each print that sets it apart from the other prints in that group.

Lesson 1 Assessment

 **Target Reading Skill Asking Questions** Use your graphic organizer to help you answer the questions below.

Reviewing Key Concepts

1. a. **Naming** What are three typical patterns of ridge lines?
b. **Classifying** The lines on a fingerprint circle around a central point. What is the pattern of this print?
c. **Making Generalizations** Why are fingerprints very useful as evidence?
2. a. **Defining** What is a latent print and how does it form?
b. **Describing** What are three methods that a CSI can use to reveal latent prints?
c. **Predicting** What method might be used to reveal latent prints on a drinking glass? On a doorknob? On a paper envelope?

3. a. **Explaining** Why do police officers collect fingerprints at a crime scene from people who are not suspects?
b. **Sequencing** List the three steps an examiner follows to compare prints.
c. **Making Generalizations** How can a computer make it easier to find a match for a print?

At-Home Activity

Family Fingerprints Use carbon from a soft pencil or an ink pad and index cards to make one fingerprint of each family member. Choose either the thumb or index finger of one hand. Explain the typical patterns of prints to your family. Then work together to classify the prints.