

Fascinating Fingerprints

by Rhonda Wilson

- 1 Fingerprints have been used as a way to identify people and animals for a long time. An amazing thing about fingerprints is that they never change, even as we grow from childhood to adulthood. Another fascinating aspect about fingerprints is that they differ from person to person. No two individuals, even identical twins, have prints that are exactly the same. The use of fingerprints for identification dates back to prehistoric times.
- 2 In ancient Babylon fingerprints were used on clay tablets for business documents, and in ancient China thumbprints were found on clay seals. One of the earliest accounts of using fingerprints for identification was in China in the seventh century. Reportedly, a debtor's fingerprints were displayed on a bill, which was given to a lender. This bill was legally recognized as proof that the

debt was valid. In the fourteenth century in Persia, official government papers displayed fingerprints to prove identity. One of the government officials of that time, a physician, noted that no two imprints were alike. In 1880 Dr. Henry Faulds published an article in the scientific journal, *Nature*, discussing fingerprints as a way to identify an individual. He also talked about using printer's ink to obtain fingerprints. As early as 1882, Gilbert Thompson of the U.S. Geological Survey used fingerprints on a document. This was the first known use of fingerprinting to prevent forgery on a paper in the United States.

- 3 In two of his novels, American writer Mark Twain in the 1800s described fingerprints as a means of identifying suspects in a criminal case. One of the books contained a dramatic description of a court trial on fingerprint

identification. In 1892 Juan Vucetich, an Argentine police official, was the first to identify a criminal through fingerprint identification. In the same year, Sir Frances Galton published a book titled *Fingerprints* after extensive study of fingerprints beginning in the 1880s. His book described a way to classify the characteristics of fingerprints. He noted especially the individuality and permanence of the fingerprint. Galton calculated that the odds of two individual fingerprints being the same were one in sixty-four billion. Many of the characteristics that he identified are still in use today and are called Galton's Details. In 1924, through an act of Congress, the Identification Division of the Federal Bureau of Investigation was formed. By 1946 the FBI had processed more than one hundred million fingerprint cards manually.

4 The pattern of ridges on the skin of our fingers, palms, toes, and soles of our feet is formed before we are born. Fingerprints have distinct differences that can be classified into several types, including the arch, the tented arch, the loop, and the whorl. An arched fingerprint has ridges that start at one side, rise to a bump in the center, and exit at the other side. A tented arch also starts at one side and leaves at the other but has at least one ridge that is at a forty-five degree angle or greater. A loop fingerprint has one or more ridges that start at one side, create a loop, and leave at the same side. A whorl fingerprint has at least one ridge that makes a complete 360-degree circle at the center. Although each individual fingerprint pattern is unique, family members may have similar patterns of whorls or loops, for example, on the same fingers of their hands.

5 The minutiae, or details, of fingerprints identified by Galton can be grouped into two categories. The first category includes bifurcation and ridge endings, which are the most common details in all fingerprints. An example of a bifurcation is a road that divides at a three-way intersection. A finger's ridge ending can be seen as a road that comes abruptly to a dead end. The second category includes all other details that are combinations of bifurcation and ridge endings.

6 Fingerprints have been systematically studied for more than one hundred years. People have worked hard to observe them, identify them, and explain their formations and source. The science of fingerprinting is based on the fundamentals of

the permanence and individuality of fingerprints. Fingerprint ridges are formed during fetal development in about the third or fourth month of pregnancy. These ridges comprise individual characteristics that do not change, even as we grow from children to adults. The ridges are made up of ridge endings, dots, bifurcation, and ridge-shaped variations. The ridge ending is the end of a ridge, as the name implies, and a bifurcation is a Y-shaped split that makes one ridge into two. A dot is a very short ridge.

7 The ridges of the fingerprints grow uniformly and in all directions. The process is similar to a drawing on a balloon. Whether inflated or not inflated, the drawing is still there. When the balloon inflates, the drawing stretches uniformly in all directions. Just as the characteristics that were drawn on the balloon do not change, the characteristics of our fingerprints do not change with growth.

8 Fingerprints are found on the epidermis, or the top covering of the skin, which is five layers thick. The appearance of the fingerprint ridge can change if all layers of the epidermis are cut deeply or injured. A scar, skin damage caused by diseases, and even paper cuts appear as jagged edges on a fingerprint and sometimes look puckered. They are easy to distinguish from the natural, smooth flowing formations found in the fingerprint ridges. Warts in the ridge area may push apart the ridges, but the ridges remain the same shape.

9 While the overall shape of finger and palm prints can be inherited, the small details in the fingerprint ridges are different in each one of us. Studies over the years have proven the individuality of fingerprints. No two people on Earth have the same ridge appearance on their fingers, palms, or soles of the feet. Even identical twins have different ridge patterns, although they may appear similar in some ways. In recent studies, monkeys that were cloned did not have the same ridge patterns as the original monkey, proving again that each fingerprint is unique. Although identical twins and cloned monkeys have DNA that is an exact match, the pattern of their fingerprints is different.

10 Fingerprints are often left on objects at a crime scene and are used in forensic science, an area of science that relates to the legal system, to identify suspects. How do we leave fingerprints on objects? When human hands

touch an item, we secrete an oily substance that is present on our skin. This oily secretion that is left behind is referred to as a latent print and may be used for identification of an individual in various circumstances. Sometimes the prints are invisible, but chemical techniques can be used to make them visible. The automated fingerprint identification system (AFIS) is used primarily to identify persons who do not want to be identified, such as those who are involved in criminal activity. The prints of known criminals have been entered into a database as permanent evidence.

- 11 The use of fingerprints to identify an individual was once only a theory, but scientific applications have grown with the study and observation of the science of fingerprinting. Although using fingerprints to identify people

has some drawbacks, it is one of the best investigative methods we have available. Note the characteristics of your own fingerprints. Can you detect the pattern? Is there a whorl or a tented arch? Is there a plain arch or a loop? Can you see the similarities of the patterns in your family? Can you see the differences? What is the minutia of your own fingerprints?

- 12 Consider the potential of fingerprinting. There are many applications for this unique science. If you like ferreting out details, you might be the perfect candidate for a career as a fingerprinting examiner. Perhaps the study of fingerprints is something that you would enjoy. Can you think of a way to apply the science of fingerprinting that no one has yet considered?

COMPREHENSION

- 1 The author's main purpose is to emphasize
 - a the history of fingerprinting.
 - b who invented fingerprinting.
 - c how the fingerprints of an individual are unique and permanent.
- 2 We know that fingerprints were used in
 - a ancient Babylon.
 - b ancient China.
 - c Both a and b
- 3 In his book *Fingerprints*, Galton describes a way to
 - a define children's fingerprints.
 - b classify fingerprints.
 - c tell the difference between the fingerprints of an adult and those of a child.
- 4 A fingerprint with a whorl has
 - a a ridge that starts at one side and ends at the other.
 - b at least one ridge that makes a complete 360-degree circle in the center.
 - c a ridge that starts at one side and ends abruptly.
- 5 Fingerprint ridges are formed
 - a after birth.
 - b after death.
 - c during fetal development.
- 6 Gilbert Thompson of the U.S. Geological Survey used fingerprints on a document in 1882 to
 - a prevent forgery.
 - b identify his father.
 - c show the size of the document.
- 7 Fingerprints are left on an object by a human hand because of
 - a a sticky substance left on the fingers after eating.
 - b the oily secretion that is present on the skin.
 - c makeup that is left on the skin.
- 8 The minutiae of fingerprints are the
 - a details of fingerprints.
 - b minutes it takes to make a fingerprint.
 - c colors of fingerprints.
- 9 People might consider a career in fingerprinting if they
 - a want to make a lot of money.
 - b enjoy finding details.
 - c like to study hands.
- 10 The only difference between your fingerprints now and when you were a baby is their
 - a indentation.
 - b size.
 - c color.

LEARN ABOUT WORDS

- A** Often you can tell the meaning of a word from other words and ideas in the story. In the paragraph, find the word that best matches the meaning below. Write the word.

- 1 narratives (2)
- 2 people who are viewed with doubt (3)
- 3 thorough (3)
- 4 by hand (3)
- 5 done using step-by-step procedures (6)
- 6 origin (6)
- 7 consist of (6)
- 8 in the same way (7)

- B** A word may have more than one meaning. Its meaning depends on the way it is used.

Look back at the paragraph to see how the word in **bold type** is used. Decide which of the meanings below matches best. Write *a*, *b*, or *c*.

- 9 **formed** (3)
a shaped or molded
b came into being
c organized or arranged
- 10 **process** (7)
a an outgrowth of tissue
b a series of actions
c progress; passage (as of time)

WORD STUDY

- C** The word *sympathy* literally means "feeling together." The root *path* comes from the Greek word *pathos*, meaning "feeling; suffering." Three other common roots from Greek are *phil* (from *philos*, "loving"), *chron* (from *chronos*, "time"), and *scope* (from *skopein*, "to see").

Use the root *path*, *phil*, *chron*, or *scope* to complete a word that will fit the sentence. Write the word.

- 11 To be sure that we reassemble on time, let's syn___ize our watches.
- 12 The lovers of music formed a ___harmonic club.

- 13 He used a micro___ to examine the bacteria.
- 14 A ___ometer measures time very accurately.
- 15 Librarians love their work because they are true biblio___es.
- 16 A history book usually discusses events in ___ological order.
- 17 The tele___ has aided scientists immensely in observing the stars.
- 18 The little child sobbed ___etically.

- D** *bene-* (good; well)
inter- (between)
tele- (from afar; far off)

A prefix is a word part that is added at the beginning of a root or a base word to change its meaning.

Use the prefixes *bene-*, *inter-*, or *tele-* to complete a word that will match the sentence. Write the word.

- 19 To photograph the tiger safely, he used a ___photo lens.
- 20 The story told of ___planetary travel between Mars and Venus.
- 21 Jonas Salk's discovery of a polio vaccine makes him a great ___factor of humanity.
- 22 Radio and other means of ___communication allow people to send messages great distances.
- 23 The old man had a kindly, ___volent nature.
- 24 He claimed to have sent the message to his son in another city by means of mental ___pathy.
- 25 To add variety to the garden, he decided to ___spense various types of flowers.

Comprehension

- | | |
|-------------|-------------|
| 1 c | 6 a* |
| 2 c | 7 b |
| 3 b* | 8 a |
| 4 b | 9 b |
| 5 c | 10 b |

If you missed any of the answers marked with a star (*), go to **Skill Builders Card** 191. Then come back to the Green level.

Learn about Words

- | | | |
|----------|--------------------|-------------------------|
| A | 1 accounts | 5 systematically |
| | 2 suspects | 6 source |
| | 3 extensive | 7 comprise |
| | 4 manually | 8 uniformly |
| B | 9 b | 10 b |

Word Study

- | | | |
|----------|------------------------|-------------------------|
| C | 11 synchronize | 15 bibliophiles |
| | 12 philharmonic | 16 chronological |
| | 13 microscope | 17 telescope |
| | 14 chronometer | 18 pathetically |

If you missed three or more answers in Part C, go to **Skill Builders Card** 140. Then come back to the Green level.

- | | | |
|----------|-----------------------------|-----------------------|
| D | 19 telephoto | 23 benevolent |
| | 20 interplanetary | 24 telepathy |
| | 21 benefactor | 25 intersperse |
| | 22 telecommunication | |

If you missed three or more answers in Part D, go to **Skill Builders Cards** 145 and 146. Then come back to the Green level.