

3M**Young Scientist Lab**in partnership with: **Discovery**
EDUCATION

Science of Summer Family Activities

DIY Detective Lab- Book 'em and Print 'em

Overview

Suspicious activity in the neighborhood? Younger siblings snooping in your room? Unsure who stole the last cookie from the cookie jar? With forensic science, you and your family can find out who has been touching every surface in your house! We all have a unique set of fingerprints that will always stay the same. These activities will help you learn the art and science of fingerprinting while you have a little fun with something that is special and unique about you!

Thought Starters

Ask these questions before you begin:

- *What is a fingerprint?*
 - *A: A fingerprint is an impression of the friction ridges, ridges that form fixed patterns, on the inner surface of a finger or a thumb.*
- *When do friction ridges develop?*
 - *A: They actually begin to develop before we are born!*
- *How many fingerprints do you have?*
 - *A: You have 10! One on every finger!*
- *Is it true or false that every person has a unique set of fingerprints?*
 - *A: It is true! Even identical twins have different fingerprints. That's why fingerprinting is a great way to identify people.*
- *Why is the examination or identification of fingerprints important?*
 - *A: Since every person has a unique set of fingerprints, identification can help identify people who are responsible for crimes, people who are missing or in accidents, or simply to make sure that people are who they say they are. You can't fake your fingerprints!*
- *Can fingerprints among family members be similar?*
 - *A: General characteristics of fingerprints (such as whorls, arches and loops) can be inherited, therefore family members do tend have similar fingerprint patterns.*

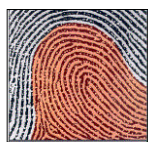
Activity #1: Make a print!

Materials

- # 2 pencils
- Pencil sharpener
- White index cards
- Scotch® Magic™ Tape or Scotch® Packaging Tape
- Magnifying glass
- Post-it® Flags

Activity

- Take a look at your fingertips. What can you observe? Do you see lines, loops, arches? You are the only person in the world who has your fingerprints! Using the steps below, you will do an activity to show you what your fingerprints look like and how they are similar and different from your family members.
- First, rub the side of a pencil tip on a white index card, covering a good-sized square, until there is a dark smudge of graphite. That's your ink pad!
- Beginning with your pinky, press the tip of your finger on the grey square. Press with a medium touch—not too light, not too hard—and gently roll from one side to the other.
- Place a 3-inch piece of clear tape firmly on the fingertip. (Better yet, have a family member or friend carefully do it for you.)
- Lift the tape off your finger and stick it on a white index card. There's your print! (You may have to practice a few times to get it right.)
- Be sure to note your name and the correct finger on the index card (e.g., Right – I = right hand, index finger).
- Once you've got the process down, do both of your index fingers and both thumbs.
- Observe your fingerprints using only your eyes. What do you see?
- Then use a magnifying glass to examine your fingerprints more closely.
- Fingerprints are categorized into three distinct patterns: loops, whorls, and arches. There are pictures of each below.
- Which type of fingerprints do you have: loop, whorl, or arch? What about family members? Do all family members share the same pattern of prints?
- What similarities and differences do you observe between your prints and those of other family members?



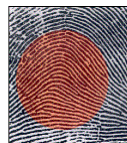
LOOP

In a loop pattern, the ridges enter from either side, re-curve and pass out or tend to pass out the same side they entered.



WHORL

In a whorl pattern, the ridges are usually circular.



ARCH

In an arch pattern the ridges enter from one side, make a rise in the center and exit generally on the opposite side.

Source: www.fbi.gov

Extensions:

Do all of your fingers (and those of your friends and family members) and create a larger collection. Label as follows: T – thumb, I – index finger, M – middle finger, R – ring finger, L – little finger (or pinkie). Use color-coded Post-it® Flags to sort them into categories.

Activity #2: Whose Print Is It?

Now that you've observed your fingerprints, it's time to put your forensic science skills to the test! In this activity, you will dust, lift and identify fingerprints to see whose glass is whose!

Materials

- Cornstarch
- Powder make-up brush
- Scotch® Magic™ Tape
- Black construction paper
- Post-it® Notes
- One glass per family member

Activity

- Have one or more family members put their fingers on a glass. (Note: Natural oils in your fingertips leave the prints, so don't wash your hands right before this activity. To make a stronger print, rub your forehead or the side of your nose first to add extra oil to your fingertip.)
- Put each glass on a table, but make sure that only one family member touches each glass!
- Sprinkle the print on each glass with cornstarch and then dust lightly with the powder brush. You should see a light outline of a fingerprint.
- Now place a 3-inch piece of clear tape over the print and gently lift it up.
- Stick on a piece of black construction paper.
- Use Post-it® Notes to make notes about each print (such as date, time and place the print was lifted as well as the pattern of the print).
- Compare each print to the family's members' prints that were recorded in Activity #1.
- Can you tell whose glass was whose? If so, you are using forensic science!

Discussion Points

- All human beings are born with ridges that shape fixed patterns on each of their fingertips. These ridges form loops, arches, and whorls that are unique to each human being, even identical twins. Other physical characteristics about us change, but fingerprints do not. We are actually able to see a baby's fingerprints by week 20 of pregnancy.
- Because every set of fingerprints is unique, physical fingerprint evidence can be used to positively identify an individual. The formal name for fingerprint science is dactyloscopy.
- Injuries such as burns or scrapes do not change our fingerprint pattern. When new skin grows back, it grows back with the exact same fingerprint pattern.
- We leave patterns or fingerprints on anything we touch with any pressure. Latent prints usually refer to ridge imprints that are inadvertently left on a surface and that are not visible to the naked eye. Using fingerprint science techniques and powders or chemicals, experts can make latent prints visible during the collection process. Patent prints, on the other hand, are left behind on a surface when a substance is moved from a fingertip to the surface. For example, a patent print would result if a person dipped his or her finger in paint and then pressed it onto a canvas. Patent prints can usually be identified without chemical processing and are often considered more reliable than latent prints.
- With a large database of fingerprints housed at the Federal Bureau of Investigations (more than 200 million), the first step in fingerprint examination is often done with a computer program that identifies possible matches. The second step often involves human examination. Examiners look at the shape of the ridges and compare the points where the ridges start, end, join and split. The positions of short ridges, dots and any enclosed areas are also noted. Examiners also search for points of similarity between the fingerprint mark and the print to try and decide if the two patterns match.
- Fingerprint identification was first used in the U.S. in 1902 when the New York Civil Service Commission fingerprinted applicants to prevent them from having more qualified applicants take their tests for them. The following year the New York prison system began to fingerprint criminals.
- Koala bears have ridges on their fingers which create fingerprints almost identical to those of human beings. According to a number of websites, this means that koala fingerprints could be confused for human fingerprints at a crime scene! As humans get identified through their fingerprints, dogs are identified by their nose prints.

- The loop is the most common fingerprint pattern. 60% of fingerprints have this pattern.

To Learn More

- Learn the way it's done at real crime labs. Check out "FBI: Taking Legible Fingerprints:" <http://www.fbi.gov/hq/cjisd/takingfps.html>
- You'll find fingerprint charts on the Internet, such as this one: <http://www.creative-chemistry.org.uk/activities/fingerprinting.htm>