

# Uncovering the Evidence



## Breakin' It Down

If some of your favorite TV shows and movies involve crime-scene tape, dusting for fingerprints, and analyzing blood splatter—then this Interest Project is for you!

## HERstory

The prime suspect in the "We want a forensics IP" case is Jacquelyn (age 14) of a Girl Scout troop in Tennessee. In an e-mail sent to Girl Scouts of the USA on Monday, January 3, 2005, at 3:25 p.m., the suspect in question even suggested the title, "Uncovering the Evidence." Case closed!

## You've Got MAD Skills

By completing activities in the "Uncovering the Evidence" Interest Project, girls across the country can:

- Analyze household "clues" using forensic science techniques.

- Create and solve fictional cases by connecting with other "crime scene investigators."

- Explore careers in forensic science and chemistry.

- Understand what forensic scientists do—analyze physical evidence to uncover truth using chemistry, biology, and physics.

## Helpful Links

There are several organizations and online resources to help you "LEARN" and "DO" the activities in this IP, like:

- The Federal Bureau of Investigation ([www.fbi.gov](http://www.fbi.gov))

- Your local police department

- The American Academy of Forensic Scientists ([www.aafs.org](http://www.aafs.org))

- The National Center for Forensic Science ([www.ncfs.org](http://www.ncfs.org))

- Discovery Channel's "On the Case" ([www.discoverychannel.com](http://www.discoverychannel.com))

## Important!

Work with an adult when conducting experiments with chemicals and take necessary safety precautions.

## Need Help?

Not sure where to begin? No problem. Read the [Intro](#) before diving into "Uncovering the Evidence." Just want a quick refresher on what to do? Okay, in order to earn any of these Interest Projects, you must:

- Do the one REQUIRED activity

- Do ONE activity of your choice from each of the THREE categories (LEARN, DO, SHARE)

- Design and do ONE activity of **YOUR OWN**

- Create a short **REFLECTION** after you've completed **all of the activities**

**Food for Thought!** Often, an activity in the "LEARN" category will help you build a skill that you'll have the chance to try in the "DO" category and then share in the "SHARE" category. Make connections between the "steps" when planning which activities you'll do. For an example of a skill-building connection, check out the fourth activity of each "Uncovering the Evidence" category.

## Uncovering the Evidence



**Required:** Identify yourself! DNA (deoxyribonucleic acid) is the genetic material that identifies all of us as unique...unless you're an identical twin. Even between identical twins, fingerprints are unique. Research the three types of fingerprints that police and the FBI use to identify people ([www.fbi.gov/hq/cjis/takingfps.html](http://www.fbi.gov/hq/cjis/takingfps.html)). Which type do you have? Find out by using clear tape, a No. 2 pencil, two pieces of paper and a magnifying glass. Rub the pencil on a piece of paper until a dark smudge appears (this is graphite). Beginning with the little finger, rub it on the smudge until the fingertip is covered with graphite. Then place a small piece of tape over your fingertip. Press the tape down gently. Carefully remove the tape and stick it on a clean, white piece of paper. Record which finger it came from. Repeat the process for the other four fingers. Examine the prints closely. Based on the three types of fingerprints, which kind do you have?

### LEARN

1. Be a forensic scientist...online! Do three of the following six activities:
  - a. Take the "Hair" quiz at <http://dsc.discovery.com/fansites/onthecase/photo/photo.html>
  - b. Participate in solving a crime at [www.crimescene.com](http://www.crimescene.com)
  - c. Crack "The Case" at [www.planet-science.com/whodunit/go/TheCase/Default.html](http://www.planet-science.com/whodunit/go/TheCase/Default.html)
  - d. Follow a case called "A Strange Flashlight" through the FBI at [www.fbi.gov/kids/6th12th/investigates/investigates.htm](http://www.fbi.gov/kids/6th12th/investigates/investigates.htm)
  - e. Solve a gruesome murder mystery at [www.virtualmuseum.ca/Exhibitions/Myst/en/game/index.phtml](http://www.virtualmuseum.ca/Exhibitions/Myst/en/game/index.phtml)
  - f. Create a DNA fingerprint and solve "It Takes a Lickin'" at [www.pbs.org/wgbh/nova/sheppard/analyze.html](http://www.pbs.org/wgbh/nova/sheppard/analyze.html)
2. Interview someone in forensics about her/his job. Consider talking to someone (either in person or on the phone) in the coroner's office, medical examiner's office, or the forensics office of your local police department. In addition to questions about their educational background, consider asking what they like about their job and the strangest thing they've encountered so far. For a complete list of careers in forensic science, check out the "Resources" section of the American Association of Forensic Scientists' site ([www.aafs.org](http://www.aafs.org)).
3. Fingerprints, hair, fibers, soil, tire tracks, footprints, bite marks, and blood are all examples of physical evidence. There isn't much that can't be analyzed to find out who left what behind. Prepare a presentation about a specific kind of evidence examination and present your findings to a group. Your presentation should help explain how a particular kind of evidence is examined (tools used, science applied) and include a brief history of how forensic scientists discovered the examination method. Consider including an example of a crime that was solved using it (famous or local).
4. Forensic science has become one of the hottest genres on television today. Make a list of the shows now on TV that involve some element of forensic science. Watch an episode of one show. Write a scene (or a script) for a forensic science drama of your own. What is the crime, how will it be solved, and who will solve it?

### DO

1. Forensic fruit files: Perform DNA extraction in your kitchen. Why would you want to extract DNA from a fruit? Besides being a cool experiment, it could be useful for solving a crime scene in your refrigerator. You'll need:

1 strawberry or kiwi	1 small glass
Salt	Cold 91% or 100% isopropyl alcohol
Tap water	Plastic wrap
1 Ziploc™ bag	1 coffee filter
Paper towel	A toothpick or coffee stirrer

Place a strawberry or kiwi in a Ziploc™ bag. Add one drop of soap to the fruit. Add a pinch of salt. Pour in a little water (no more than four teaspoons). Mash the mixture in the bag to a pulp. Pour the mixture through a wet paper towel into a small glass. Once the mixture has finished draining into the glass, remove the towel. Slowly pour the cold alcohol down the sides of the glass so that it forms a separate layer on top of the mixture (don't stir these contents). Watch for a few minutes until a white glob forms at the interface of the two liquids. This "glob" is DNA! Use the toothpick or coffee stirrer to remove the DNA strands. Place them on plastic wrap for examination. If you have a microscope, examine the strands more closely.

Check out how and why this process works at [www.life.uiuc.edu/hughes/footlocker](http://www.life.uiuc.edu/hughes/footlocker) click on "Biotech lab ideas for your classroom" and then the "DNA in a Lunchbox: Isolate DNA from Fruit and Make a DNA Smoothie!" link.

2. Make arrangements for your group (or a class at your school) to visit your local police department's forensics office and learn about different positions or jobs within a forensic department. If a group visit isn't possible, arrange for them to come speak to your group about what they do.

3. Having a career in forensics doesn't always involve chemistry, biology, mathematics, or physics. Your artistic talents could translate into a career as a forensics photographer, artist, or sculptor. Test your ability to be any one of these by 1) staging a crime scene and photographing it in detail; or 2) having someone describe a person you've never met and then sketch or sculpt what that person looks like. Refer to the FBI's Handbook of Forensic Services for descriptions of how to photograph and sketch for forensic purposes ([www.fbi.gov/hq/lab/handbook/intro16.htm](http://www.fbi.gov/hq/lab/handbook/intro16.htm)).

4. Being a crime-scene investigator requires heightened powers of observation. Test your own powers by drawing a diagram of your first period or homeroom classroom from memory (no peeking). Include as many objects as you can remember, along with their correct location and orientation (this includes seating arrangements, people's names and physical appearance). The next day, compare your diagram with the actual classroom—how accurate are you?

## SHARE

1. The tibia of a 22-year-old female measured 31.5 cm. How tall was she? If you know basic algebra, you can help police identify how tall the victim was by using the formula below. Scientists discovered the relationships between height and the length of each bone after much study and data collection. The bones that are used are the femur (F), tibia (T), humerus (H), and radius (R).

### Bone Formula for Females

*(P represents the person's height. The last letter of each formula stands for the unknown length of the bone)*

Femur

$$P = 61.412 + 2.317F$$

Tibia

$$P = 72.572 + 2.533T$$

Humerus

$$P = 64.977 + 3.144H$$

Radius

$$P = 73.502 + 3.876R$$

Impress your teachers by challenging a class to solve CSI problems like the one **you** just solved. The challenges you come up with can be trickier if the age of the victim is known. After the age of 30, a person's height decreases at the rate of about 0.06 cm per year.

2. Host an "Identity Crisis" party for a group. The party's main activity should be the REQUIRED activity (above) in a **group** setting. After everyone has been "printed," explain the three types of fingerprints and review the group's fingerprints to determine which type each person has. Keep a tally in order to discuss the findings: is one type more common than another type? Is one type rare? Create a collage or catalog of your group's fingerprints. Consider playing games like "Clue" and serving "finger food." NOTE: the REQUIRED activity is to be completed as an individual whereas this SHARE activity is to be completed a group (the same activity but in different settings). The first time, you learn the skill for yourself; the second time, you share the skill with others.

3. Design and present a forensic science lesson for your school or a Girl Scout group. Use resources on the Web or your local police department for ideas. The lesson should include an introduction to what forensic science is and an activity/experiment that the entire group does. (Consider an assignment you may already have at school—could this satisfy it?)

Organize a "CSI" night for your group, friends, or family. Watch a TV show like "CSI," "Forensic Files," "The New Detectives," and "FBI Files." Play a game along with the show like tracking the number or kinds of forensic tools and techniques used (microscopes, Luminol, profiling, etc.), careers portrayed, or make up a game of your own.

**Sources:** Marilyn Fenichel, educational writer; Wendy Goldfein, sixth-grade teacher, Fairfax County School District, Virginia

<http://school.discovery.com/lessonplans/programs/forensics/>

Patricia Roberto's "Forensic Science in the Middle School Math Classroom." Roberto is a math teacher at Rogers Middle School (Pittsburgh Public Schools).