



Special Agent

A special agent wears many hats—detective, scientist, psychologist, enforcer of the law. No wonder novels and shows about their work are so popular! In this badge, grab your magnifying glass and your microscope, and uncover your skills in one of the most exciting—and demanding—jobs for investigative minds.

Steps

1. Investigate investigation
2. Reveal reality
3. Try the science
4. Key in to body language
5. Practice the art of detection

Purpose

When I've earned this badge, I'll know secrets from the worlds of forensic science and criminal psychology.

"I have said, 'How much science needs women!'"

—Maria Mitchell, astronomer
(1818–1889)

"Women are the future of forensic science."

—William B. Eggleston, chair of
Virginia Commonwealth
University's forensics program

Every step has three choices. Do ONE choice to complete each step. Inspired? Do more!

STEP 1 Investigate investigation

Cultivate the faculty of remembering time. Some people can say a certain thing happened on a certain day but do not know the hour even approximately. When I am in the city and hear the fire alarm I am sure to notice the time. It may some time be good evidence."

—How Girls Can Help Their Country, 1913

It seems nearly every drama on TV is about criminology. Nancy Drew is as popular now as when her character came to life in 1930. And these days, you can spend your summer vacation at forensic science camp. Take a look at why this is such a hot topic.

CHOICES – DO ONE:

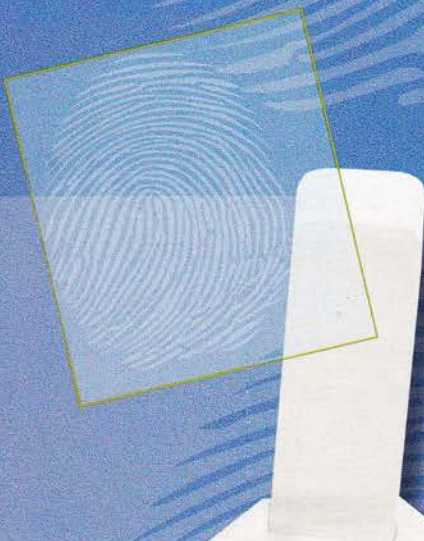
- Organize a CSI-themed night for your group, friends, or family.** Watch one episode of a crime scene or other investigation show. Play a game along with the show, like tracking the forensic tools and techniques used: luminol, profiling, field gadgets, and lab equipment. Or make up a game that zeroes in on forensic psychology or archaeology.

OR

- Host an "Identity Crisis" party.** Fingerprint yourself and your guests. After everyone has been printed, identify the types of prints each person has. (There are about seven types; many websites have information.) Keep a tally and discuss the findings. Is one type more common than others? Is one type rare? Create a collage or catalog of the fingerprints.

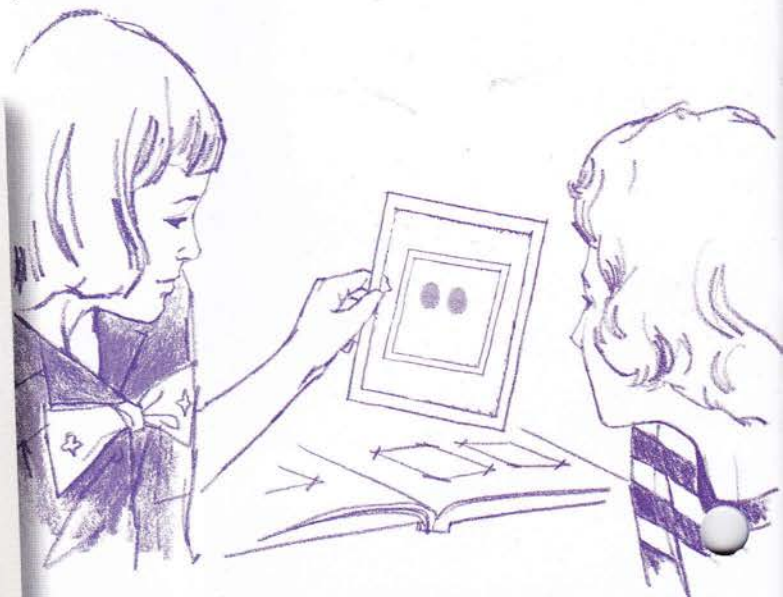
FOR MORE FUN: Play detective games like Clue, and serve finger food.

- OR
- Play Jane Bond.** Women have a history of being amazing special agents, both in reality (Julia Child worked for the Office of Strategic Services during World War II) and in fiction (detectives Miss Marple and Enola Holmes). Read a book about a real or fictional female special agent (detective, crime investigator, forensic scientist, or code-breaker) and share some of her spy or detection techniques with friends.



How to Fingerprint

Gather some friends, and, using clear tape, a No. 2 pencil, two pieces of paper, and a magnifying glass, have each girl 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 the fingertip. Press the tape down gently. Carefully remove the tape and stick it on a clean, white piece of paper. Record which finger the print came from, and repeat the process for the other fingers.



STEP 2 Reveal reality

You see this scene constantly on medical shows: The heart monitor flatlines, and the nurses and doctors grab the defibrillator paddles. In truth, a defibrillator is used to steady a rapid or erratic heart rhythm, not restart a flat one! Search out similar myths and realities about forensics.

CHOICES –DO ONE:

- Interview someone in forensics.** Visit a police department's forensics office, and find out about jobs in the department. What looks the same as on TV, and what's different? Ask the staff about their educational backgrounds, what they like about their jobs, the strangest things they've seen—and what they find amusing from TV! (If you can't visit, arrange for someone to speak to your group, or interview them on the phone. You could also find an expert in the coroner's or medical examiner's office, or a journalist with a police beat.)

OR

- Try the eyewitness challenge.** Have someone run into your meeting room, grab an item or ask a question, then leave in a flash. Then have every girl write down everything she remembers about the person. Compare reports, then have the person come back. How accurate was your "eyewitness testimony"?

FOR MORE FUN: Make and compare composite drawings (sketches of the "suspect")—or maybe ask a sketch artist to come in and give tips.

OR

- Make some impressions.** Get a group together. Have one half be the "suspects" and ride bikes or walk through sand, gravel, or light mud. The other plays "detective" and tries to match each suspect's bike tires or shoes to the tracks or footprints.

FOR MORE FUN: Switch roles!

More to Explore

Look into the reliability of eyewitness reports. The Innocence Project has been using DNA evidence to free prisoners who were wrongly convicted before DNA technology was available. Of the first 293 cases, fully half of the prisoners were convicted on eyewitness testimony alone. Eyewitness testimony can be wildly inaccurate, because what people think they see can be affected by weather, stress, health, and personal bias. Ask a law-enforcement officer, judge, lawyer, or other expert to share stories of people wrongly convicted.

Some Types of Forensic Scientists

Criminalists investigate physical evidence from crimes. They may try to find a match for a fingerprint or see what kind of gun a bullet came from.

Digital and multimedia scientists look for digital evidence. They may examine a suspect's computer to see if files have recently been deleted, or examine photographs for details about a crime.

Engineering scientists use math and science to learn more about a case. They often investigate plane or car crashes.

Forensic dentists (odontologists) use dentistry to find evidence. They may examine teeth found at a crime scene or examine a bite mark to find a suspect.

Forensic pathologists are medical doctors who investigate crimes. They may examine bodies to find out how they died or analyze blood from a crime scene.

Forensic anthropologists identify people who have been killed, then help figure out the cause of death. They are often called to investigate large disasters like fires or plane crashes.

Toxicologists study the effects of harmful substances on the human body. They may help figure out if a person was killed by natural causes or by some type of poison.



STEP 3 Try the science

From the biology of insects that can determine time of death to the precise physics that determine a bullet's trajectory, forensic experts need to know all types of science. Experiment with how forensic specialists use one of these classic sciences.

CHOICES –DO ONE:

- Forensic chemistry.** Chromatography is the process forensic scientists use to separate the parts of a mixture so their individual parts can be analyzed. The method can be used to detect poisons or drugs present in a body, to find traces of explosives, or to identify ink in stains or ransom notes. Try ink chromatography in the experiment on page 6.

OR

- Forensic physics.** Ballistics and blood spatter analysis can be used to figure out the path and direction of a bullet or another impact. Try a “spatter” analysis in the experiment on page 7.

OR

- Forensic biology.** Every person's DNA is unique, so DNA evidence can be used to identify a suspect or a victim. Try extracting the DNA from a banana in the experiment on page 8. Or, if you have the help of an expert and a serious interest in biology, try an experiment in DNA “fingerprinting,” or profiling.

More to Explore

Check out case studies. Find three examples of crimes that were solved with scientific data, and share the science behind the evidence with your group. You might even share your findings with Juniors earning their Detective badge!



Bone Formula for the Average Female

P represents a person's overall height; all measurements are in centimeters.

Femur

$$P = 61.412 + (2.317 \times \text{length of femur})$$

Tibia

$$P = 72.572 + (2.533 \times \text{length of tibia})$$

Humerus

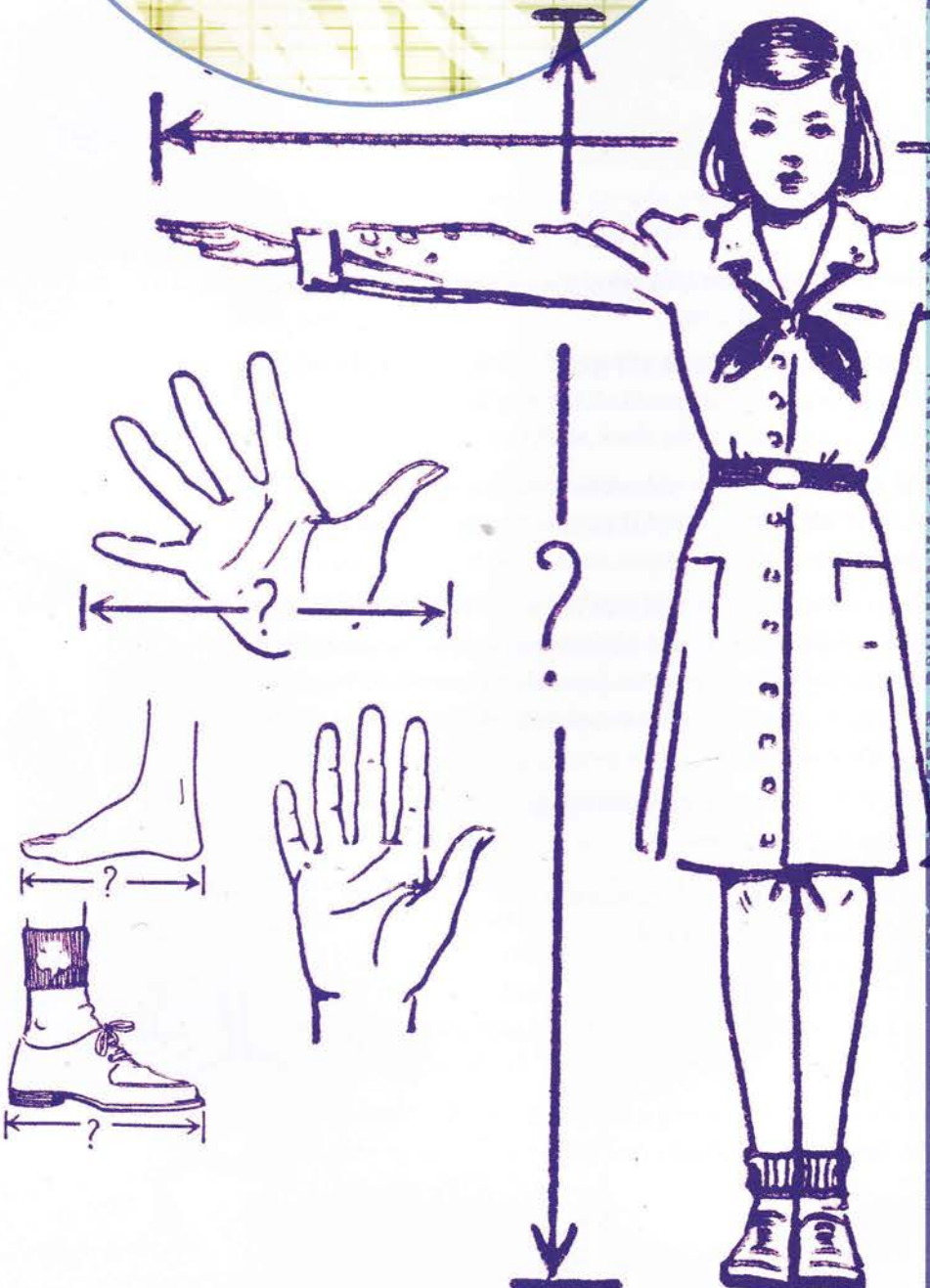
$$P = 64.977 + (3.144 \times \text{length of humerus})$$

Radius

$$P = 73.502 + (3.876 \times \text{length of radius})$$

The Bones Know

If you know basic algebra, you can help police identify how tall a victim was by using the formulas below. Scientists discovered the relationships between our height and the length of our bones after much study and data collection. Bones used are the femur, tibia, humerus, and radius.



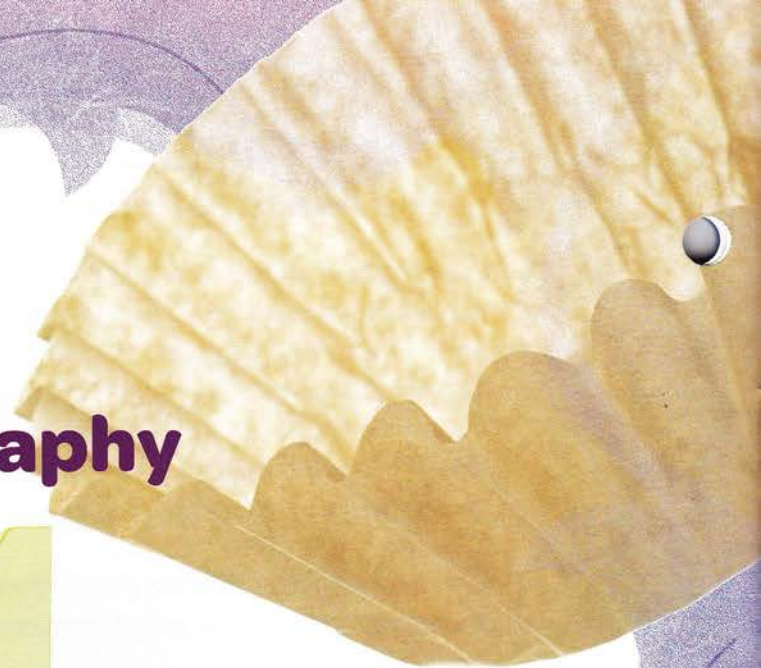
Q: If a 22-year-old female's tibia measures 31.5 cm, how tall is she?

The challenges can be trickier if the age of the victim is unknown. After the age of 30, a person's height decreases about 0.06 cm per year.



FORENSIC CHEMISTRY:

Coffee Filter Chromatography



Materials:

Paper cup (16-oz. cups work well)
Coffee filters
Black marker
Pencil
Tape
Rubbing alcohol (99% works best)
Water
Ruler

Procedure:

- 1 Cut coffee filters into strips that are about $1\frac{1}{2}$ inches wide and the same height as the paper cup.
- 2 About $\frac{1}{4}$ inch from the bottom of the coffee filter strip, use a ruler to draw a horizontal line in pencil all the way across. Draw a dot in the center of the line using the black marker.
- 3 Mix equal portions of water and rubbing alcohol and put enough of the mixture in the cup so that it coats the bottom—it should be less than $\frac{1}{4}$ inch deep.
- 4 Hold the pencil horizontally and tape the top of the coffee filter strip to the pencil. Position the pencil horizontally across the top of the paper cup so that the strip hangs into the liquid. Make sure that the very bottom of the filter paper is touching the liquid but that the liquid is still below the ink dot on the filter paper.
- 5 Wait 15–20 minutes for the ink to travel up the filter paper. How many colors do you see?

FOR MORE FUN: Try different black markers and pens around your house to see how many colors they separate into!



FORENSIC PHYSICS:

Interpreting Blood Spatter

Materials:

2 packets of cherry-, strawberry-, or raspberry-flavored Crystal Light (enough to make 4 quarts)
2 teaspoons boiling water
Paper cup
Straw
Coffee stirrer
White construction paper
Ruler



Procedure:

- 1** To make fake blood, carefully add 2 teaspoons of boiling water to the paper cup, and then add the Crystal Light.
- 2** Stir the mixture until the Crystal Light is completely dissolved, and let cool.
- 3** While the “blood” is cooling, cut white construction paper into 10 pieces (approximately 4 inches by 6 inches each). Take 5 of the pieces and lay them out on a flat surface.
- 4** Dip a straw into the cooled “blood” and drip one drop onto the first piece of paper from a height of approximately $\frac{1}{2}$ inch. Then drip a drop of the “blood” onto the other 4 pieces of paper from different heights (for example, 1 inch, 6 inches, 12 inches, and 18 inches). How does the size of the drop change as the height is increased?
- 5** Take another piece of construction paper and, while holding the paper at an angle, use the straw to place a drop of “blood” on the paper. Repeat this for the last 4 pieces of construction paper, but each time hold the paper at a different angle. How does the size of the drop change as the angle of the paper is increased?
- 6** Lay two large pieces of construction paper side by side on a flat surface and hang another two pieces on the wall directly behind them (a table pushed against a wall works well). Stand about one foot away from the paper and dip a coffee stirrer into the “blood” mixture. With your arm moving across your body, very quickly flick your wrist toward the wall, spraying the “blood” onto the paper. Look at the blood spatter on the paper. The drops should be elongated (teardrop shaped) with the thinner end of the drop pointing in the direction it was traveling. Can you confirm the direction of the blood spatter?

FOR MORE FUN: Do this as a group. Then exchange your cards with others in the group, and try to guess the height and angle each drop came from.



FORENSIC BIOLOGY: Extracting DNA from a Banana

Materials:

Blender (optional)
3 paper cups (at least 16 oz. each)
Plastic spoon
Half a peeled banana
1 cup plus 4 teaspoons water
2 teaspoons liquid soap
2 pinches salt
2 teaspoons rubbing alcohol (99% works best)
Strainer
Toothpicks

Directions:

- 1 About 30 minutes before you start the experiment, place the alcohol in the refrigerator.
- 2 Cut a banana into small pieces and place into a blender with 1 cup of water. Blend for 15–20 seconds, until well mixed. Pour the mixture into the first paper cup. If you don't have a blender, place the banana in a bowl, add 1 cup of water, and mash with a fork. Then transfer to the first cup.
- 3 In a second paper cup, add 2 teaspoons liquid soap, 2 pinches of table salt, and 4 teaspoons of water.
- 4 Slowly stir the soap/salt/water mixture with a plastic spoon to dissolve the salt and soap.
- 5 Pour the soap solution into the cup containing the banana mixture, and stir continuously with the plastic spoon for 5–10 minutes.
- 6 Place the strainer over the third paper cup, and pour the banana/soap mixture through the strainer into the third cup. Let the mixture drain for several minutes.
- 7 Add 2 teaspoons of cold rubbing alcohol to the solution in the cup. Gently swirl the solution to mix the rubbing alcohol with the banana/soap solution. Look at the top layer and see if you can see the DNA appear. It has the appearance of white, stringy mucus.
- 8 After about 5 minutes, use a toothpick to remove the DNA from the top layer, or remove the DNA with a spoon, slowly tipping out the excess liquid.



STEP 4 Key in to body language

Detectives often need to keep their feelings and ideas under wraps while they talk to a suspect. How do these experts keep their cool in an interrogation, and how do they read the body language of others?

CHOICES -DO ONE:

- Find out about "tells."** Unconscious face and body movements that indicate untruths are known as "tells." Card players use them as an important piece of their game strategy—eliminating tells is using your "poker face"! Research common tells, then host a card-game tournament to see tells in action. What are yours? Can your newfound knowledge help you make them less obvious?

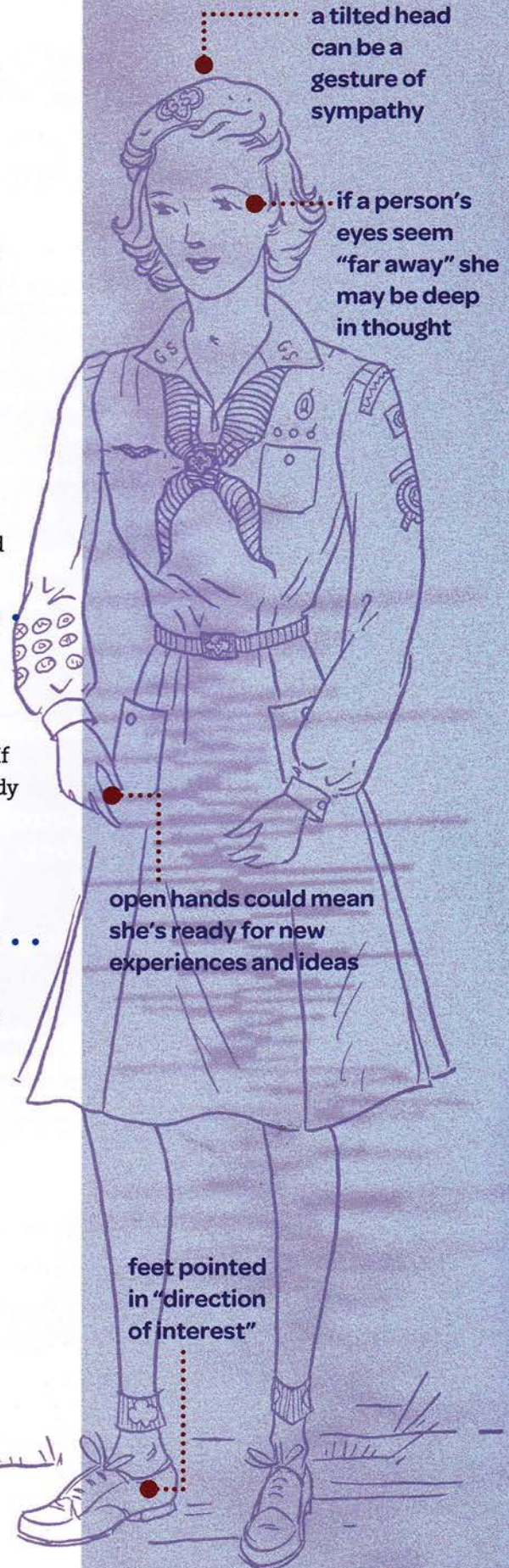
OR

- Research body language.** Want to appear confident? Make strong eye contact, and don't jiggle your feet, legs, or fingers. Don't want anyone to know you're angry? Unclench your fists. Find out what body gestures and positions mean, then look at photos in magazines. If you were interrogating the people in the photos, what would their body language tell you?

FOR MORE FUN: Videotape yourself or look through photos of yourself. What messages are you sending the world?

OR

- Check out voice analysis.** It's not just body language that separates lies from truth. A suspect's tone of voice can speak volumes. Do a little research on this, then tape and analyze your own voice in different conversations under different circumstances. Can you tell when you were stressed or excited?



SIGNS SOMEONE MIGHT BE LYING

Do you ever get a gut feeling that someone is lying to you, even if you're not sure why? You may be picking up on physical and verbal signals without even realizing it. When people lie, they often show it with subtle signs like these:

- Not making eye contact
- Blushing
- Raising vocal pitch
- Touching their face or scratching their nose
- Fidgeting
- Repeating words like "honestly" or "truthfully"
- Leaving out details in a story, or changing the story when it's told repeatedly
- Blinking frequently

STEP 5 Practice the art of detection

Having a career in forensics doesn't always involve chemistry, biology, math, or physics. Your artistic talents could translate into a career as a forensics photographer, artist, or sculptor. You could write scripts for all those TV shows we've been talking about. You could be a spy—or just dress up like one!

CHOICES -DO ONE:

- Write a scene or script for your own forensic-science drama.**

What is the crime, how will it be solved, and who will solve it?

FOR MORE FUN: Perform your script for an audience.

OR

- Sketch or sculpt a "suspect" or photograph a "crime scene."**

Have someone describe a person you've never met and sketch or sculpt that person. Or stage a crime scene, and take detailed photos. See the FBI's *Handbook of Forensic Services* for descriptions of how to photograph and sketch for forensic purposes.

OR

- Create or re-create a spy scenario and design a disguise.**

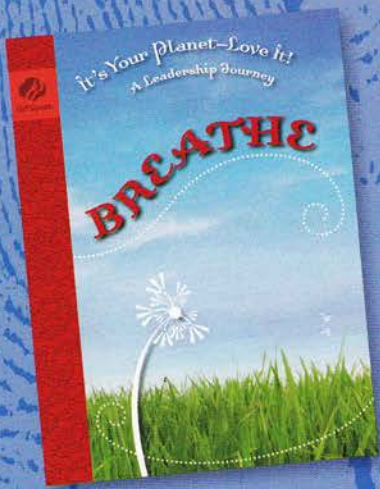
The trick is to dress up enough to cover your recognizable features and to blend into the environment in which you'll be sleuthing. Go for costume, makeup, and hairstyle—get as detailed as you'd like! Ask your Girl Scout friends to do the same, and critique each other's disguises.

Polygraphs

A polygraph—sometimes called a lie detector—works by measuring a person's physical responses after they are asked a question. It may measure blood pressure, pulse, or breathing rate. Some scientists don't believe polygraph results are an accurate way to detect lies.

Careers to Explore

- Mystery author
- Private investigator
- Research scientist
- Forensic scientist (see sidebar in step 2)
- FBI special agent
- Detective
- Security expert
- Therapist
- Social worker
- Psychiatrist
- Foreign-language teacher
- Cryptographer or cryptologist (code-breaker)
- Forensic psychologist, specializing in:
 - criminal justice
 - law enforcement
 - correction facilities
 - rehabilitation facilities
 - crime prevention
 - education
 - research
 - profiling



Add the Badge to Your Journey

Your *Breathe* Journey invites you to use all five of your senses to become more aware of what's in the air. When you do step 2, choose to interview someone in forensics and ask for examples of how senses have been used to solve cases. For example, what can you learn with the sense of smell? Sound? What case examples use clues from the air?

Now that I've earned this badge, I can give service by:

- Suggesting a great detective novel to friends
- Showing a Junior working on her Detective badge how to fingerprint
- Sharing excitement about forensic science careers



I'm inspired to: