

# **Crime Scene Investigation:**



**A Challenge from the  
BC Program Committee**

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# 1 Introduction

Welcome to the BC Program Committee's Crime Scene Investigation challenge! With the current popularity of mystery-solving TV shows, games and movies, girls and Guiders alike are very interested in forensic science. Really, what better way to bring some STEM (Science, Technology, Engineering and Math) into your program than to connect it to something the girls find fascinating? So here it is. We hope that you and your girls will have some fun, learn something new and discover what it is that forensic investigators actually do.

## 1.1 Objective of the Challenge

This challenge is designed to introduce girls and Guiders to concepts in forensic science and to the work done by forensic investigators.

## 1.2 About This Booklet

This booklet outlines a variety of activities for you and your girls to choose from when deciding how to earn the challenge crest. While all of the activities are related in some way to forensic investigations, many of the activities can be used in virtually any context at all. Section 2 gives puzzles that can be quiet activities at any meeting or camp. Section 3 tests observation skills with a variety of Kim's-type games. Section 4 contains art and craft projects that can be done anytime, as part of a CSI-themed meeting or on their own. Sections 5 and 6 present hands-on forensic science activities and Section 7 has suggestions for guest speakers and field trips. In section 8, investigate how forensic science is used in real life.

Don't feel restricted to the activities in this booklet. We have included a "Resources and Links" section (page 56) to help you find other activities or more details on the ones given in this booklet. Feel free to substitute. As long as the activity you substitute is challenging for your girls and meets the objective of the challenge, you can earn the crest.

### 1.3 Taking the CSI Challenge

To earn the challenge, you'll do a variety of activities from each section. The number of activities required to earn the crest is different for each Guiding branch, as described below.

Branch		Sparks	Brownies	Guides	Pathfinders	Rangers	Adults
Do at least this many activities:		4	5	7	9	10	10
Including this many from each of these categories:	Puzzles	1	1	1	1	1	1
	Observation Games	1	1	1	1	1	1
	Arts, Crafts and Drama	1	1	1	1	1	1
	Forensic Science Activities		1	1	2	3	3
	Guest Speakers and Field Trips			1	1	1	1
	Forensic Science in Real Life			1	1	1	1

### 1.4 How to Order the Crests

Crests will be sent to your area program adviser. When you have completed the CSI Challenge, send the Crest Order Form (available from the BC Girl Guides website or on the last page of this booklet) to your area program adviser (APA), via your district program adviser if you have one. She will send you the crests.

APAs: if you have run out of crests, please contact the BC Program Committee so we can get some more out to you.

## 1.5 A Word of Caution Concerning Violent Crime

Thanks to popular TV shows, forensic science is often seen as a way of solving very violent crimes. In reality, it is used to answer questions in an extremely broad range of cases—anything from murder investigations to accounting fraud, art forgeries and cyber crime.

In this booklet, we have tried as much as possible to emphasize the wide variety of areas in which forensic science is used and to present activities in a non-violent context. However, you should be aware that many girls, even younger ones, have had some exposure to violent crime, either through popular media or (sadly) through their own experiences. Consequently the more violent, disturbing applications of forensic science may come up in your group's discussions; some girls may be quite frightened or traumatized by such discussions. Please use your judgment and consider the girls' ages, sensitivities and personal experiences when deciding what activities are appropriate for your group.

A variety of resources are available to help you lead discussions with your girls about violent crime. Please refer to the "Resources and Links" section on page 56.

## 2 Puzzles

### 2.1 Spot the Differences

Check your local library or bookstore or do an Internet search for “spot the difference” puzzles to challenge your girls with. If you want some puzzles with a Guiding theme, check the STEM Resources section of the BC Girl Guides website or contact your District or Area Program Adviser.

### 2.2 CSI Word Search #1

E V I D E N C E C L W I  
Z F N I L T M A R B I E  
F I N G E R P R I N T S  
G O Y R C M P S M M N C  
K E O R Z G U B E E E I  
S K N T T S B K S M S S  
U E X E P S O V C I S N  
W X U E T R I D E R U E  
L G C L D I I M N C T R  
A T H V C K C N E D H O  
B E C I L O P S T H N F  
E V I T C E T E D S C A

CHEMISTRY  
CLUES  
CRIME  
CRIME SCENE  
DETECTIVE  
DNA  
EVIDENCE  
FINGERPRINTS  
FOOTPRINTS  
FORENSICS  
GENETICS  
LAB  
POLICE  
RCMP  
SUSPECT  
WITNESS

#### CSI Word Search #1 Solution:

**E V I D E N C E C L W I**  
**Z F N I L T M A R B I E**  
**F I N G E R P R I N T S**  
**G O Y R C M P S M M N C**  
**K E O R Z G U B E E E I**  
**S K N T T S B K S M S S**  
**U E X E P S O V C I S N**  
**W X U E T R I D E R U E**  
**L G C L D I I M N C T R**  
**A T H V C K C N E D H O**  
**B E C I L O P S T H N F**  
**E V I T C E T E D S C A**

## 2.3 CSI Word Search #2

E R F C L T W R E O B D N C B J I  
C E O U H C C C C A W N O F L T N  
N P O G W R I E L M T A I S O R V  
E O T K R L O E P E P N T S O A E  
D C P J O O M M V S G V U E D C S  
I S R P N I T I A E U P C N T K T  
V O I L R N T A R T T S E T Y I I  
E R N C E C E P G L O C S I P N G  
Z C T J E H R O Y I W G O W E G A  
D I S T R I C T A T T O R N E Y T  
W M E S N C L U E S Z S P A L G I  
L D J T G E N E T I C S E C P Y O  
S I S Y L A N A R I A H S V E H N  
I M P R E S S I O N S I R B N V Y  
P L U U E N E C S E M I R C S I I  
F O R E N S I C S C I R B A F R T  
Y R T S I M E H C A W V D S O Q E

BLOODTYPE  
CHEMISTRY  
CHROMATOGRAPHY  
CLUES

CRIME LAB  
CRIME SCENE  
CSI  
DETECTIVE  
DISTRICT ATTORNEY  
DNA  
EVIDENCE  
FABRICS  
FINGERPRINTS  
FOOTPRINTS  
FORENSICS  
GENETICS  
HAIR ANALYSIS  
IMPRESSIONS  
INVESTIGATION  
INVESTIGATOR  
MICROSCOPE  
POLICE  
PROSECUTION  
RCMP  
SUSPECT  
TRACKING  
WITNESS

### CSI Word Search #2 Solution

**E R F C L T W R E O B D N C B J I**  
**C E O U H C C C C A W N O F L T N**  
**N P O G W R I E L M T A I S O R V**  
**E O T K R L O E P E P N T S O A E**  
**D C P J O O M M V S G V U E D C S**  
**I S R P N I T I A E U P C N T K T**  
**V O I L R N T A R T T S E T Y I I**  
**E R N C E C E P G L O C S I P N G**  
**Z C T J E H R O Y I W G O W E G A**  
**D I S T R I C T A T T O R N E Y T**  
**W M E S N C L U E S Z S P A L G I**  
**L D J T G E N E T I C S E C P Y O**  
**S I S Y L A N A R I A H S V E H N**  
**I M P R E S S I O N S I R B N V Y**  
**P L U U E N E C S E M I R C S I I**  
**F O R E N S I C S C I R B A F R T**  
**Y R T S I M E H C A W V D S O Q E**

## 2.4 CSI Word Search #3

Find all the listed words, then copy the unused letters, starting from the top right, into the spaces below until you discover the secret phrase.

S G I P I R E L G U I D D E S M A T E K E E X C E  
 E L N A L E C N T D E E N E C T N I P V E S F O R  
 I L N T C S N I G U A O S A B I N C O J L R E V J  
 N A O H J W E N B C Q C T B R F A J C D M U S N L  
 W T C F B X D C H X R I G P B D D P S X F K H N R  
 O I E I I E I G K I L L R M S Y S S O R I D B H S  
 R P N N Q X V T P I P E K P A P E R R E C I L O P  
 B S T D L T E T Q Z G K K K N G J A C L E F C N C  
 L O G E T V I U T N O Y U E K C N B I W Y O T Q L  
 X H U R E O I D I U J L Q P H E P I M N D C T I U  
 H R I S N D O F R R G F A A N I Q A F T E X L A W  
 F H L T K U G Z P N A V R Q Q Q K V M Y S U N E A  
 V K T U W M A P L Q V G L G E N U V G Y C I G P W  
 G T Y P S L H B U I E I R M X P Q L U B R D L E W  
 P I C T U R E K C D A D P I D E T E C T I V E B M  
 D K Z J N F Z K Q J F I K G C J I L T A P L T A W  
 X V S I D O O Z X F I A K K S W N Q Q I T V Z Y X  
 D Q I X W L I Y O G N O M N Q T F T I Y I S I K L  
 U C E E U G A B Y P H N T H B B Z G S O O V E Q I  
 R G V N U Z W H H F A K K S E E V S S E N L U Z B  
 J Z Y V K Z I J O D Q H B V B V F G N M D I A Z R  
 B A O P N H M D O N K Y K W Y S C U I I A I J E A  
 D M J W S N X O O N E G X N K B H E C F N H U Y R  
 C E B I P K L F O V E X Z E J L F I R U D J P G C  
 G H F I O B O C X H I G F P T X X S J X O V X Q N

BAG  
 CHARGED  
 DETECTIVE  
 FINGERPRINT  
 HOSPITAL  
 LIQUID  
 PATHFINDERS  
 POLICE

BLOOD  
 CULPRIT  
 DNA  
 GUIDES  
 INNOCENT  
 MAGNIFY  
 PEN  
 SPY

BROWNIES  
 DESCRIPTION  
 EVIDENCE  
 GUILTY  
 JAIL  
 MICROSCOPE  
 PICTURE

-----  
 -----

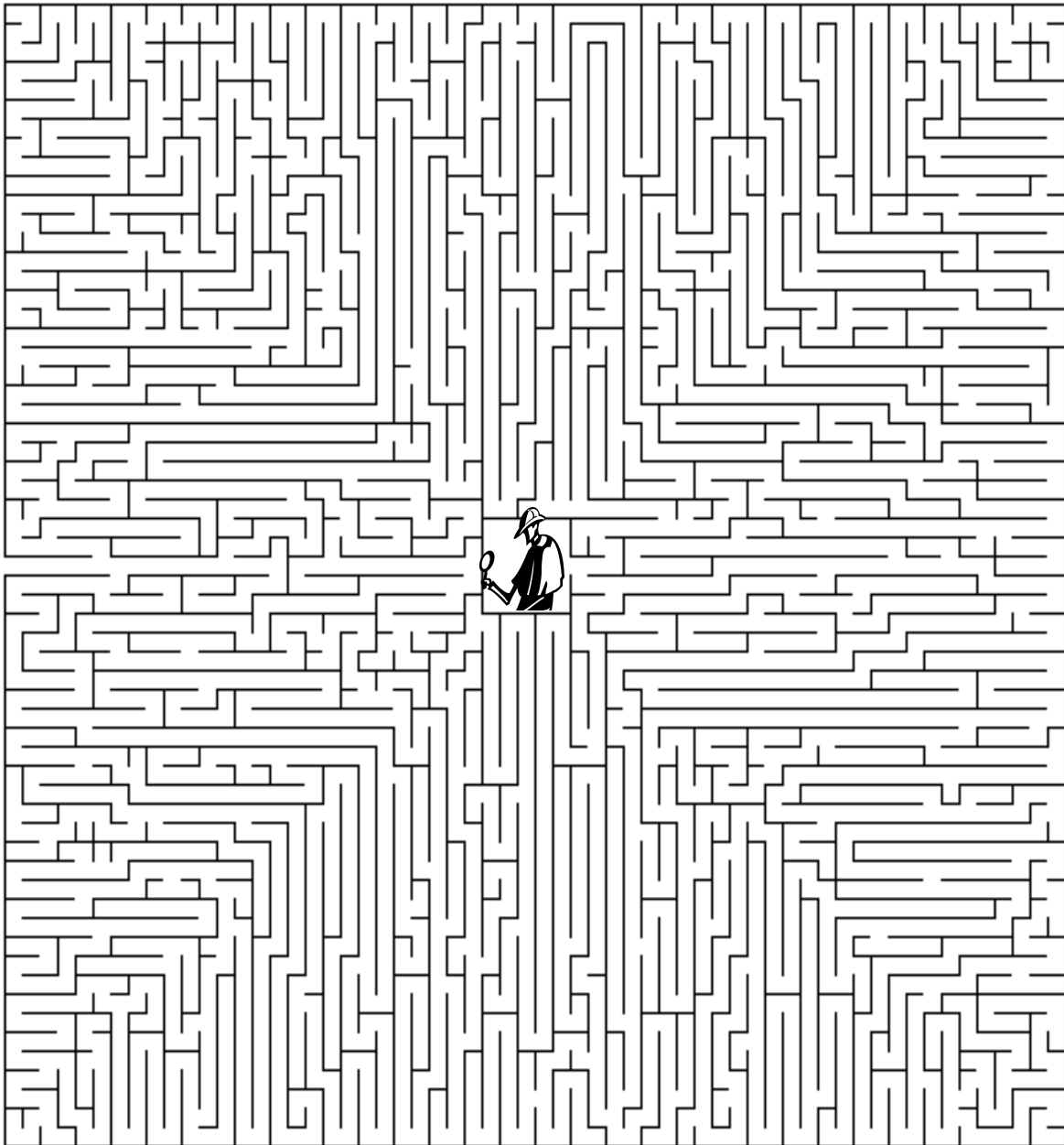
**CSI Word Search #3 Solution:**

**S G I P I R E L G U I D D E S M A T E K E E X C E**  
**E L N A L E C N T D E T N E C T N I P V E S F O R**  
**I L N T C S N I G A I O S A B I N C O J L R E V J**  
**N A O H J W E N B C Q C T B R F A J C D M U S N L**  
**W T C F B X D C H X R I G P B D D P S X F K H N R**  
**O I E I I E I G K I L L R M S Y S S O R I D B H S**  
**R P N N Q X V T P I P E K P A P E R R E C I L O P**  
**B S T D L T E T Q Z G K K K N G J A C L E F C N C**  
**L O G E T V I U T N O Y U E K C N B I W Y O T Q L**  
**X H U R E O I D I U J L Q P H E P I M N D C T I U**  
**H R I S N D O F R R G F A A N I Q A F T E X L A W**  
**F H L T K U G Z P N A V R Q Q Q K V M Y S U N E A**  
**V K T U W M A P L Q V G L G E N U V G Y C I G P W**  
**G T Y P S L H B U I E I R M X P Q L U B R D L E W**  
**P I C T U R E K C D A D P I D E T E C T I V E B M**  
**D K Z J N F Z K Q J F I K G C J I L T A P L T A W**  
**X V S I D O O Z X F I A K K S W N Q Q I T V Z Y X**  
**D Q I X W L I Y O G N O M N Q T F T I Y I S I K L**  
**U C E E U G A B Y P H N T H B B Z G S O O V E Q I**  
**R G V N U Z W H H F A K K S E E V S S E N L U Z B**  
**J Z Y V K Z I J O D Q H B V B V F G N M D I A Z R**  
**B A O P N H M D O N K Y K W Y S C U I I A I J E A**  
**D M J W S N X O O N E G X N K B H E C F N H U Y R**  
**C E B I P K L F O V E X Z E J L F I R U D J P G C**  
**G H F I O B O C X H I G F P T X X S J X O V X Q N**

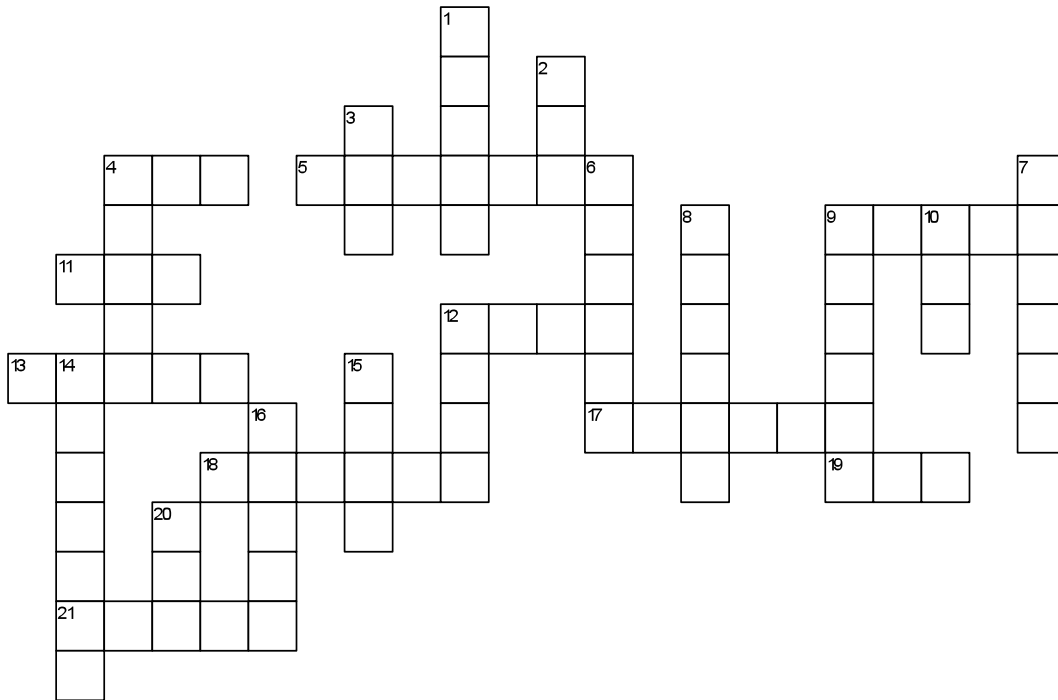
G I R L G U I D E S M A T E K E E X C E L L E N T D E T E C T I V E S F O R C S I

## 2.5 Super-Sleuth Maze

Show the detective the way to the robber!



## 2.6 CSI Crossword Puzzle



www.CrosswordWeaver.com

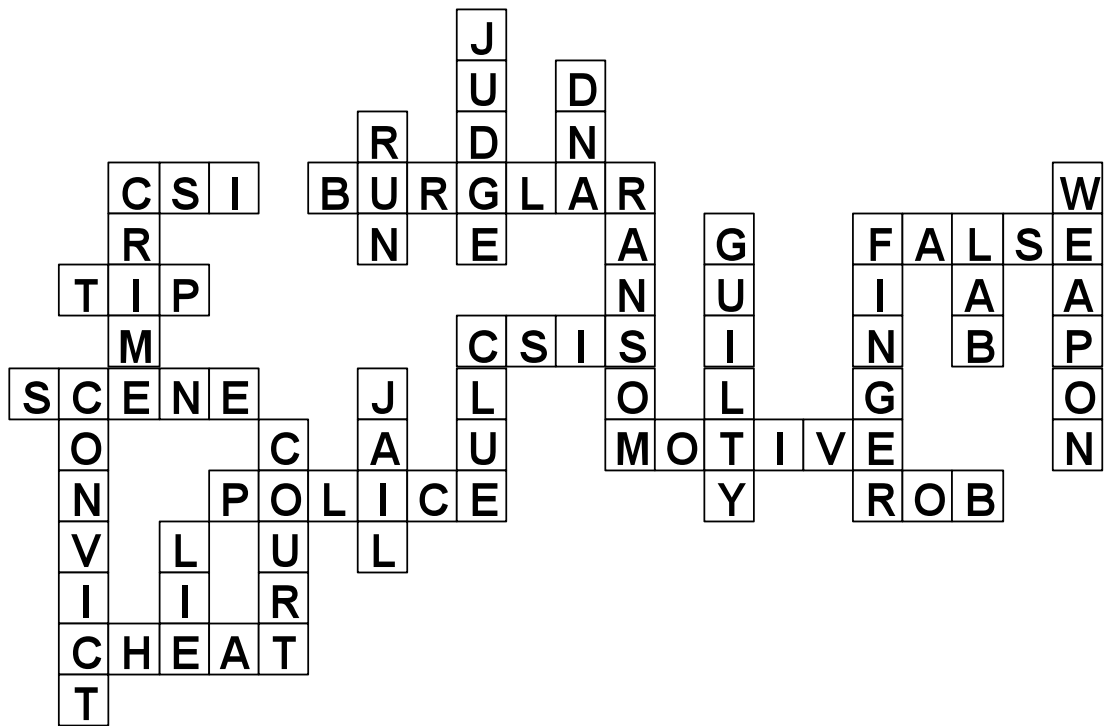
### ACROSS

- 4 Crime Scene Investigation (abbr.)
- 5 Robber
- 9 Untrue
- 11 Clue given to police
- 12 Canadian Security Intelligence Service (abbr.)
- 13 \_\_\_ of the crime: where it takes place
- 17 Reason for committing a crime
- 18 RCMP, for example
- 19 Steal
- 21 Trick or swindle

### DOWN

- 1 Person who runs a trial
- 2 Genetic material
- 3 Get away quickly
- 4 Theft or murder, for example
- 6 Money demanded by kidnappers
- 7 Object used to hurt someone
- 8 Responsible for a crime
- 9 \_\_\_ print
- 10 Where evidence is analyzed
- 12 Hint
- 14 Find guilty of a crime
- 15 Place where criminals are put
- 16 Place where criminals are tried and sentenced
- 20 \_\_\_ detector: Polygraph test

# CSI Crossword Puzzle Solution



### 3 Observation Games

Forensic investigators must be very observant, able to spot tiny clues and remember the smallest details. Observant people also make the best witnesses. Play these games to test your own observation skills.

#### 3.1 Kim's Game

**What you need:**

- a variety of everyday objects. They may be related to a particular theme or chosen randomly.
- cookie sheet or similar tray
- cloth

**What to do:**

1. Place the objects on the tray and cover them with the cloth.
2. When the girls are ready, let them study the objects for 30 seconds.
3. Cover the objects again and ask the girls to list them all.

The more objects you use, the more challenging this game is. You can make it easier by putting the girls into small groups and letting them work together to name all the objects.

#### 3.2 How Good a Witness Are You? Version 1

**What you need:**

- a partner

**What to do:**

1. Ask all the girls to find a partner.
2. While one partner turns her back, the other partner makes three changes in her appearance. For example, she might tuck in her shirt, put her hair behind her ear and remove her belt.
3. When she has finished, her partner turns around and tries to identify the changes.

#### 3.3 How Good a Witness Are You? Version 2

**Advance preparation:**

Before your meeting, arrange for a volunteer to dress in peculiar attire (bright colours and patterns, funny hat, mismatched socks or shoes, lots of costume jewelry, etc.).

**What to do:**

1. During the meeting, have the volunteer walk quietly through the room, taking care to walk past each girl.
2. Once the volunteer has left the room, have the girls describe everything they can remember about her or him. Ask questions to see how much they observed.

### 3.4 How Good a Witness Are You? Version 3

#### What you need:

- several large colour photos (e.g., full-page pictures from a magazine), each of which clearly shows details of a different person

#### Advance preparation:

1. For each photo, create a list of ten questions about the details in the picture. The questions can start off fairly easy (e.g., “Is the person male or female?”) and progress to more difficult (e.g., “What colour is the ring on the person’s right index finger?”). Make the level of difficulty appropriate for the age of the participants.

#### What to do:

1. Separate the girls into small groups. Give each group one photo to study.
2. When the girls feel they have memorized the photo (or after a set time limit), take the photos away and hand out the questions. Challenge the girls to answer all the questions about their photo.

### 3.5 How Good a Witness Are You? Version 4

#### What you need:

- a room with many objects in it

#### What to do:

1. Have the girls study the room carefully, noting what objects are in it, where they are and how they are positioned.
2. Ask the girls to leave the room.
3. Move or remove a couple of objects, then call the girls back and ask them to identify what has changed.

### 3.6 I Spy...

Get an “I Spy” book from your local bookstore or library. Challenge the girls to find the hidden item in each photo.

Create your own “I Spy” scene using everyday materials or pictures cut out of magazines.

### 3.7 What Just Happened?

**What you need:**

- television
- VCR

**What to do:**

1. Turn on the TV and VCR. Record a few minutes of a TV show while you watch carefully.
2. Turn off the TV and write down everything that happened, including who did what and what they said.
3. Rewind the tape and compare your notes with the actual show. How many details were you able to recall accurately?

### 3.8 What's That Noise?

**What you need:**

- a variety of common items that make noise, e.g., telephone, mixer, bell, computer keyboard and so on (or recordings of common sounds)

**What to do:**

1. Ask the girls to turn their backs so they can't see what you are using to make noise.
2. Start up each of the noise-makers in turn and ask the girls to identify the sound.

### 3.9 What's That Smell?

**What you need:**

- a variety of common items with a strong—but not harmful—scent, e.g., vanilla, grapefruit, cloves, cinnamon, licorice, ripe strawberries, lavender, etc.
- paper cups or similar containers
- cotton balls

**What to do:**

1. Place one item in each cup and cover it with a cotton ball so that you can't see it.
2. Ask the girls to try to identify the item in each cup using only their sense of smell.

### 3.10 What's That Texture?

**What you need:**

- a variety of common items with distinct textures and/or shapes, e.g., different types of fabrics, flour, sandpaper, popcorn, etc.
- tea towels

**What to do:**

1. Place one item under each tea towel so that you can't see it.
2. Ask the girls to try to identify the item under each tea towel using only their sense of touch.

## **4 Arts, Crafts and Drama**

### **4.1 CSI Colouring Pages**

You can find colouring pages related to a CSI theme in colouring books and online (try a search for “kids colouring pages” and you’ll turn up all sorts of them). CSI-related colouring pages might include pictures of police officers, scientists, laboratories, burglars and so on.

### **4.2 Fingerprint Art**

Make bookmarks, cards and matching envelopes, note paper and more! Turn your own fingerprints into flowers, animals or comical characters. Combine several characters into a storybook. Make your fingerprint art on craft foam and pin it to your hat. You can even use your creations as thank-you gifts for the people who help you earn your CSI Challenge crest.

#### **What you need:**

- non-toxic ink pad (washable ink makes for easier clean up, but permanent ink is better if you are planning to colour over the fingerprints with marker)
- paper, card stock, envelopes and/or craft foam, depending on what you are making
- markers, crayons or pencil crayons

#### **What to do:**

1. Press your thumb or finger onto an ink pad then onto your card stock.
2. Use a fine marker, crayons or pencil crayons to add details.

### **4.3 Shrink Art CSI Crafts**

Use Shrink Art (available at craft stores and in the craft section of discount or family stores) to create miniature investigation gloves or magnifying glasses. If you use a hole punch to make a hole in the craft before shrinking it, you can add a safety pin for a hat craft afterwards.

## 4.4 CSI Hat Crafts

### 4.4.1 Evidence in a Bag

#### What you need:

- wig
- scissors
- tape
- non-toxic ink pad (washable ink makes for the easiest clean up)
- paper
- red acrylic paint
- mini resealable bag
- safety pin

#### What to do:

1. Cut a lock of hair from the wig and tape the cut ends together.
2. Roll your finger on the ink pad then onto paper. Cut out the fingerprint.
3. Put a small drop of red paint onto a piece of paper to represent a drop of blood. Let the paint dry.
4. Put everything in the bag, seal it and add the safety pin to the top.

### 4.4.2 Microscope Slide

#### What you need:

- clear contact laminate
- non-toxic paint
- hole punch
- safety pin

#### What to do:

1. Place a piece of laminate on a table sticky side up.
2. Put small blobs of paint onto the laminate. The blobs should be in a line and spaced about 10 cm apart.
3. Lay another piece of laminate sticky side down on top of the first sheet. Be careful not to flatten out the paint blobs.
4. Press around the paint drops with your finger, leaving a blister of paint.
5. Cut the laminate into strips about 2 cm wide and 10 cm long, with a paint blob on each strip.
6. Punch a hole at one end and add the safety pin.

### 4.4.3 Lab Coat

**What you need:**

- white craft foam
- scissors
- fine-point permanent marker
- safety pin

**What to do:**

1. Cut the craft foam into the shape of a lab coat. It can be as large or as small as you want.
2. Use the marker to add details (e.g., pockets, buttons, collar points, etc).
3. Add the safety pin to the top.

### 4.4.4 Mad Scientist

**What you need:**

- white yarn
- scissors
- tab from the top of a pop can
- googly eyes
- glue
- safety pin

**What to do:**

1. Cut about 10 pieces of yarn, each about 7.5 cm (3 inches) long.
2. To make the mad scientist's hair, fold one piece of yarn in half. Loop the fold around the top of the pop can tab and pass the ends through the loop. Pull it tight around the tab.
3. Repeat step 2 for each piece of yarn. Frizz out and fluff the "hair."
4. Glue on the googly eyes just below the hair.
5. Add the safety pin to the top of the tab at the back.

## 4.5 Make Your Own Detective Kit

### What you need:

- plastic tackle, tool or craft box
- magnifying glass
- measuring tape or ruler
- plastic or latex gloves (watch for allergies)
- tweezers
- ink pad and paper
- pad of paper and pencil
- small resealable bags
- fine-tip marker

### What to do:

1. Put all the supplies for storing and protecting supplies into the tackle box.
2. Use your detective kit as you work on the other activities in the CSI Challenge:
  - a. Use the magnifying glass to inspect clues closely.
  - b. Use the measuring tape and ruler for mapping crime scenes.
  - c. Use the gloves and tweezers to pick up clues without damaging them.
  - d. Use the ink pad and paper for taking fingerprints from suspects.
  - e. Note down details of the crime scene with the paper and pencil.
  - f. Store clues in resealable bags labelled with details of the crime scene (e.g., what the clue is, where it was found).

## 4.6 What Is This?

### What you need:

- camera (film or digital)

### What to do:

1. Take photos (or have the girls take photos) of everyday objects using a very odd angle or an extreme close-up view.
2. Print the photos or upload them to a computer so that everyone in the group can see them.
3. Try to identify the objects in the photos.

## 4.7 CSI Photography

Do this activity by itself or as part of “Crime Scene Investigation: A (Sort Of) Instant Meeting” on page 40.

### What you need:

- camera (film or digital)
- crime scene with several props (e.g., evidence, clothing, everyday objects overturned, etc.)

### What to do:

1. Set up the crime scene in advance of your meeting.
2. Have the girls take photos of the crime scene. Encourage them to decide what is important to record in a photo.
3. Remove the crime scene and ask the girls questions about it (e.g., “How many \_\_\_\_ were there?” or “Where was the \_\_\_\_?”). Can they answer the questions based only on the photos they took?

## 4.8 Mock Trial

In a mock trial, girls take on the roles of judge, defense and prosecution lawyers, witnesses and jury members at the trial of someone charged with a crime. They hear testimony, cross examine witnesses, weigh the evidence, then decide the verdict.

For younger girls, you may want to have the roles in your mock trial fully scripted, so the girls who are acting as witnesses, the judge and the lawyers simply read their parts. The jury, however, is free to decide “guilty” or “not guilty” based on the evidence they have heard.

Older girls, especially ones with a dramatic flair, may prefer to improvise the dialogue. In this kind of mock trial, each witness is given a summary of her character’s view of the events leading up to the crime and some guidelines about what kind of person her character is. The lawyers examine and cross examine the witness, who answers based on this information. Again, the jury is free to decide “guilty” or “not guilty” as they see fit.

The Law Court Education Society of BC has a number of mock trials, available free of charge, that are suitable for a range of ages. See the “Resources and Links” section on page 56 for contact information. You can also find some online; try entering “mock trial Canada” into a search engine. Note: there are differences between court systems and procedures in Canada and the US, so you may want to stick with mock trials from Canadian sources.

## **4.9 Murder (or not) Mystery Game**

Hold a mystery party in which participants assume the character of someone involved in a murder or other crime. Each player quizzes the other characters to force them to disclose information and (if she can) keeps certain information to herself. At the end, each participant tries to solve the mystery based on the information revealed.

Commercial mystery games are available and include scripts and costume suggestions for each character, some props to be used as clues and often audio or audio-visual materials that add to the atmosphere.

You can buy mystery games at games stores and occasionally in larger bookstores. There are also websites where you can order a mystery game and download it immediately; see the “Resources and Links” section on page 56 or try entering “murder mystery kids” into a search engine to find sites with games intended specifically for kids. (As always, exercise caution before buying online or downloading materials from unfamiliar sites.) Alternatively, see if you can borrow a used game from a friend or colleague.

A note of caution: Always check that the game you are intending to use is appropriate for the people who will be playing it. Mystery games meant for adults or older kids may include explicit violence, suggestive or coarse language, adult situations and other elements that you or your girls might not be comfortable with.

## **4.10 Mystery Reading**

Read a book that has a mystery or CSI theme (there are some suggestions in the “Resources and Links” section on page 56 or choose your own book). Tell your unit about the book.

## **4.11 Mystery Movie Night**

Organize a party or sleep over for your unit and watch a movie or TV show that has a mystery or CSI theme. Better yet, do this as a bridging activity with another branch—just be sure the show you choose is appropriate for every age you’ve invited.

## 5 Forensic Science Activities

What exactly is forensic science? The official definition is “the application of scientific knowledge to legal problems.”<sup>1</sup> In other words, forensic science uses scientific principles and methods to analyze evidence that can be used in a court of law. Thanks to popular TV shows, we tend to think of forensic science as something used mostly for violent crimes like murder, but in real life forensic science is applied to evidence in all kinds of situations—everything from arson and art forgery to insurance fraud and cyber crimes.

Law enforcement officials and forensic investigators analyze lots of different types of evidence to solve crimes and bring the accused person to trial. This section provides hands-on activities to help you understand the work of a forensic scientist.

### 5.1 Messages, Ransom Notes and Other Documents

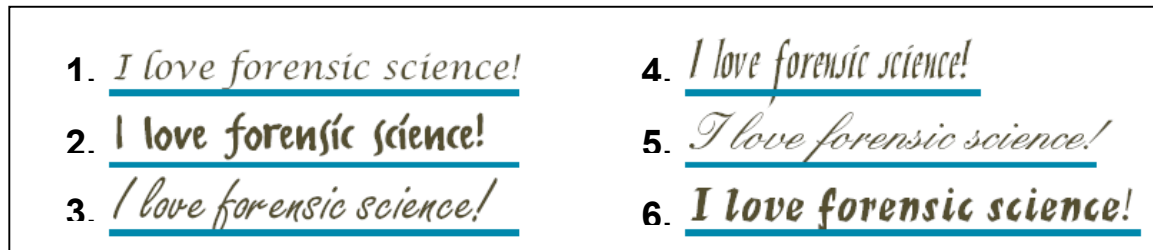
Sometimes the evidence in a crime is in the form of a written document—perhaps a ransom note in a kidnapping, a rewritten will or a forged cheque in a fraud case. Investigators who examine these suspect documents—called “questioned documents”—look at the paper, the ink, the pen or the printer (or typewriter) that laid down the ink, the handwriting and even the wording and punctuation of the document to figure out who wrote the document, if it was altered and when.

#### 5.1.1 Handwriting Analysis

When forensic investigators look at the handwriting on a document, they look at the following things:

- the form of the handwriting, such as the shapes of the letters and their slant, angles, connections and curves
- the thickness of the line, which depends on the type of writing instrument used and the pressure exerted
- the arrangement on the page, including spacing, alignment and formatting
- the content, including the spelling, phrasing, punctuation and grammar

Here are some examples of different types of handwriting:



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<sup>1</sup> Merriam-Webster's Online Dictionary, [www.merriam-webster.com/dictionary](http://www.merriam-webster.com/dictionary). Accessed March 17, 2008.

1. Spacing between letters and words: In example #1, there is not much space between the words. In example #4, there is more space between letters compared to the other examples.
2. Size of the letters, especially the height compared to the width: In example #2, the letters are tall and skinny. In example #6, the letters are short and fat—they are not as tall relative to their width.
3. The strokes that connect capital letters to lower-case letters and that connect lower-case letters together: In example #5, most of the letters in each word are connected together. In example #4, none of the letters are connected.
4. Unusual letter formations such as loops and curls or a combination of printing and writing: If you compare the letters *i* and *f* in the examples above you'll see that they are very different in each of the examples.
5. Slant of the letters to the right or left and the angle of the slant: In some of the examples above the letters are very slanted to the right (like in example #5). In others (example #6), they are more vertical, and in example #2 some of the letters slant slightly to the left.
6. Writing above, on or beneath the line: Some people tend to write certain letters below the line, or to leave a space between their letters and the line.
7. Crossing of the letter *t* and dotting of the letter *i*: People tend to make these marks in unique ways. For example, some people make the dot over the letter *i* look like a little circle.

In this activity, compare the handwriting on a ransom note with writing samples provided by suspects to figure out which suspect wrote the note.

**What you need:**

- writing samples from two or more people who have volunteered to be suspects
- ransom note

**Advance preparation:**

1. Have one of your suspects write a ransom note. Don't tell the participants who wrote it.
2. Ask each of your suspects to write a simple phrase or sentence on a piece of paper in their normal handwriting. Each suspect should write the same phrase and it should contain some of the same words as the ransom note. Note: the writing on the writing samples should be of the same style (printed or written) as the ransom note.

**What to do:**

1. Compare the writing on the ransom note with the handwriting samples provided by each of the suspects.
2. Decide which suspect was most likely the one who wrote the ransom note.

## 5.1.2 Ink Chromatography

Ink, especially black ink, is often a mixture of several different colours. Different types or brands of ink use different mixtures of colours. Ink chromatography is a method of separating individual colours from the mixture. By analyzing the ink on a crime-scene document, forensic investigators can determine what kind of pen was used to write the document or if the document was altered later with a different pen. In this activity, analyze several pens to find out which one was used to write a ransom note.

Note: Ink chromatography destroys the ransom note! If you are also planning to use this ransom note for handwriting analysis, either make a copy of it or do the handwriting activity first.

### What you need:

- coffee filter or paper towel
- several different types of non-permanent black felt pens<sup>2</sup>
- small dish of water
- ransom note written with one of the pens

### Advance preparation:

1. Write a ransom note using one of the felt pens, but don't tell the participants which pen you used. Use regular printer or loose-leaf paper. (The inks might not run as well on heavier paper.)

### What to do:

1. Cut the coffee filter or paper towel into strips about 2 cm wide and 10 cm long.
2. Using one of the pens, mark a large dot about 1 cm from one end of a coffee filter strip. At the other end of the strip, note which pen you are testing.
3. Place the very tip of the paper strip into the dish of water so that the water wicks up the strip. Don't dunk the ink dot directly into the water. As the water travels up the strip, it will pull the ink dot apart into bands of different colours.
4. Repeat steps 2 and 3 for each type of pen. Note the differences in the colour bands of each pen.
5. Now test the ransom note. Cut a piece out of the ransom note that has a good amount of ink on it. Dip the very end of the piece into the water and let the ink run as in step 3 above.
6. Compare the colour pattern on the ransom note with the colour patterns from each of the pens you tested. Which pen was most likely used to write the note?

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<sup>2</sup> It's a good idea to test out your pens ahead of time so that you know they work well. Try washable kids' markers and water-soluble (non-permanent) overhead markers.

## 5.2 Fingerprints

Fingerprints are a pattern of ridges, called friction ridges, that form (where else?) on your fingers. (They also form on the palms of your hands and the soles of your feet, but it isn't very often that a toe print is left at the scene of a crime.)

Fingerprints are unique—each of your fingers has a slightly different fingerprint and nobody in the world has the same fingerprints as you do. How do we know this, you ask? Well, it is a difficult thing to absolutely prove, but in the century or so that people have been keeping track of fingerprints in huge databases, no two identical ones have ever been found. Even identical twins have different fingerprints. That's because fingerprints aren't genetic. Although the general pattern of fingerprints is influenced by heredity, the tiny details are formed in an accidental manner in the third month of pregnancy.

Fingerprints can be classified into three main ridge formations: the loop, the whorl and the arch.



Loop



Whorl



Arch

- **Loops:** In a loop, the ridges enter from one side of the print, bend around and exit on the same side they entered on. Loops can be radial (with the tail on the thumb side of the finger) or ulnar (with the tail on the pinky-finger side of the finger). Loops are the most common fingerprint feature, making up about 60—70% of fingerprint patterns.
- **Whorls:** In a whorl, some of the ridges make a complete turn of 360°. That turn might be a nice, neat circle as in the picture above, it might be an oval or it might be a random shape (called an “accidental” whorl). The important thing is that the ridges make a closed shape. Between 25% and 35% of fingerprint patterns are whorls.
- **Arches:** In an arch, the ridges run from one side of the finger to the other. They may be quite flat or gently curved (plain arch) or they may form quite a distinct peak (tented arch), but they never turn back the way they came. Arches are fairly rare, making up only about 5% of all fingerprint patterns.

In the activities below, you look at your own fingerprints and classify them based on their main features. You also lift fingerprints from objects at a crime scene and compare them to fingerprints obtained from several suspects to see if you can figure out who committed the crime.

### 5.2.1 Looking at Your Own Fingerprints—Method 1

#### What you need:

- white paper
- graphite pencil
- transparent tape—not the “magic” invisible kind
- magnifying glass

#### What to do:

1. Heavily shade an area of the paper with the pencil and rub your finger onto the shaded area.
2. Press a piece of transparent tape onto your dirty finger, then stick it to a clean part of the paper.
3. Use the magnifying glass to examine your fingerprint. What features (loops, whorls or arches) do you see?

### 5.2.2 Looking at Your Own Fingerprints—Method 2

#### What you need:

- ink pad in a dark colour, preferably washable
- white paper
- magnifying glass

#### What to do:

1. Press your finger onto the ink pad, then onto a sheet of white paper. Be careful not to smudge it!
2. Use the magnifying glass to examine your fingerprint. What features (loops, whorls or arches) do you see?

### 5.2.3 Lifting Fingerprints as Evidence

#### What you need:

- clean drinking glass. One with a stem is easier to handle without smudging the fingerprints on it.
- cocoa—sifted works best
- small spoon
- transparent tape—not the “magic” invisible kind
- white paper
- magnifying glass
- sample fingerprints from two or more people who have volunteered to be suspects

#### Advance preparation:

1. Ahead of time, have one of your suspects press her fingers onto the glass, being careful not to smudge the fingerprints she leaves. You get clearer fingerprints with slightly oily or sticky fingers, so have your suspect run her fingertips over her forehead before touching the glass.
2. Take fingerprints from each of your suspects. (Alternatively, bring the suspects into your meeting and have the girls take their fingerprints.)

**What to do:**

1. Take fingerprints from each of the suspects. (If you are short of time, take the suspects' fingerprints in advance.)
2. Carefully handle the glass by the rim, the base or the stem so that you do not smudge the fingerprints left by the suspect. Hold the glass up to the light to find out where the fingerprints are.
3. Using the small spoon, sprinkle a little cocoa over one of the fingerprints, making sure the print is completely covered. Gently blow off the excess cocoa.
4. Press one end of a piece of transparent tape to the glass to one side of the fingerprint, then stretch the tape across the fingerprint and down onto it. Be careful not to drag the tape across the fingerprint or to press it down onto the fingerprint with your fingers.
5. Lift the tape off the glass and stick it to a sheet of white paper.
6. Use the magnifying glass to examine the fingerprint. What features (loops, whorls or arches) do you see?
7. Compare the fingerprints from the glass to the sample prints provided by the suspects. Which suspect is the most likely culprit, based on the fingerprint evidence?

## 5.3 Dental Impressions

Odontology is the scientific study of the structure and diseases of the teeth. Teeth and bite marks are sometimes important pieces of evidence in a police investigation. Dental records can help identify victims of very violent crimes or bodies that have been dead so long they aren't identifiable by any other features. Dental records are also helpful in identifying victims of large disasters such as fires or airplane crashes. People whose teeth show a lot of restorative dental work (fillings, crowns, etc) are often easier to identify than people who have perfect teeth with no dental work.

Forensic odontology can do more than identify victims; it can also help identify suspects. Occasionally, partially-eaten food items are left at the scene of a crime or the victim of an attack may have suffered bites. The tooth marks can be compared to dental impressions taken from suspects to help identify the person who committed a crime.

In these activities, you make dental impressions and compare them to bite marks left at a crime scene.

### 5.3.1 Making Dental Impressions—Method 1

#### What you need:

- foam plate or tray (make sure it has been washed thoroughly if it once held food)
- scissors
- markers

#### What to do:

1. Cut the foam plate into six equal wedges. Cut about 3 cm off the pointed end of the wedges.
2. Stack two of the wedges on top of each other.
3. Place the two wedges as far into your mouth as you can (without choking, of course) and bite down firmly on them.
4. Remove the wedges from your mouth. Label the top wedge "Top Teeth" and label the bottom wedge "Bottom Teeth." Put your name on both wedges.
5. Study your dental impressions. What characteristics do you notice? For example, how many teeth are there in the top and bottom impressions? Are there any spaces, chips, missing teeth, etc?

### 5.3.2 Making Dental Impressions—Method 2

#### What you need:

- non-toxic modeling clay
- plaster of Paris
- old tray, plastic plate or similar item for catching spills and drips
- marker

#### What to do:

1. Mold a large piece of modeling clay into a thick sausage shape about 10 cm long.
2. Press the clay firmly onto your top teeth. Carefully pull the clay away to reveal the tooth prints in a clay mold.
3. Set the mold into an old tray and pour plaster of Paris into the mold. When the plaster is dry, pull away the clay. Label the plaster cast with your name and "Top Teeth."
4. Repeat for your bottom teeth, labeling the plaster cast "Bottom Teeth."
5. Study your dental impressions. What characteristics do you notice? For example, how many teeth are there in the top and bottom impressions? Are there any spaces, chips, missing teeth, etc?

### 5.3.3 Using Dental Impressions to Identify Suspects

#### What you need:

- thick piece of chocolate or firm cheese
- dental impressions from two or more people who have volunteered to be suspects

#### Advance preparation:

1. Have one of your suspects bite cleanly through the piece of chocolate or cheese. Make sure there is a clear bite mark.
2. Make dental impressions for each of your suspects. (Alternatively, bring the suspects to your meeting and have the girls make dental impressions for them.)

#### What to do:

1. Place the bitten chocolate or cheese on a plate in a prominent location. Tell the girls that someone stole your snack and you want to find out who it was.
2. Introduce the suspects and have the girls make dental impressions for each of them. (If you are short of time, make the suspects' dental impressions in advance.)
3. Compare the dental impressions from each of the suspects to the bite mark in the food. Decide which suspect is most likely the thief.

## 5.4 Hairs and Fibres

Hairs and fibres (from clothing, for example) can be very hard to find at a crime scene, because they are usually pretty small. However, they are very often present and if investigators can just find them they can provide lots of very valuable information about the crime.

Human hair can pinpoint the age, race and gender of an individual. Hair absorbs elements from the bloodstream, so it can provide information about the food a person eats, the water they drink and the air they breathe. Investigators can even tell where a person has lived and for how long by analyzing the trace elements in that person's hair. Hair can also be very revealing in the case of poisonings. Investigators can work out how often a person was given a dose of a poison and how strong those doses were. Hair can also provide DNA evidence, especially if the root is still intact. The condition of the roots can help investigators determine if the hair fell out naturally or if it was pulled out during a struggle. Hair is also extremely durable. Investigators can find it at a crime scene or on an object used in a crime long after the crime has been committed and on bodies that are otherwise in an advanced state of decomposition.

Cloth fibres are also commonly found at the scene of a crime or on a suspect. In some cases, investigators might find a small piece of cloth that they can later match up to a hole in a piece of clothing that belongs to the suspect or victim. More often, though, investigators have to work with tiny fibres that are left behind, for example, when a crook brushes up against an object in the crime scene. By collecting fibres from different locations, investigators can tell exactly where a person has been.

In the activity below, you analyze a tiny scrap of fabric and compare it to clothing taken from a number of suspects. You can also do a similar activity with human hair, if you like; however, you will need either a microscope or a very strong hand magnifying glass to see much detail.

### 5.4.1 Analyzing Cloth as Evidence

In a real crime scene, investigators often find only fibres. In this experiment, you do similar tests as forensic investigators would do on those fibres, only you'll use a larger scrap of cloth to make it easier to handle and observe.

The "Basic" analysis is suitable for girls of all ages. The "Advanced" and "No Coming Back From This" analyses are better suited for older girls.

#### **What you need:**

#### **Basic Analysis:**

- scissors
- small cups or similar containers
- permanent marker
- masking tape
- clothing taken from each of two or more suspects
- strong magnifying glass
- paper and pen for writing down your observations

**Advanced Analysis:** Supplies from the basic analysis, plus

- rubber gloves
- vinegar
- nail polish remover containing acetone
- two small glass dishes
- tweezers
- paper towels

**No Coming Back From This Analysis:** Supplies from the basic analysis, plus

- candle in a stable candle holder or a Bunsen burner
- matches or butane lighter
- metal tongs or forceps
- pot holder or oven mitt
- baking sheet or similar heat-proof surface

**Advance preparation:**

1. Find similar clothing for each of your suspects—for example, a blue shirt for each. The more similar the clothing material is, the more challenging this experiment will be.
2. Cut or tear a small scrap from a piece of clothing from one of the suspects. This is the scrap that was found at the crime scene.

**What to do:**

**Basic Analysis:**

1. Use the scissors to remove a small piece from each piece of suspects' clothing. Place the cloth samples in a small paper cup labeled "Suspect #1," "Suspect #2," etc. Put the cloth scrap from the crime scene into another cup labeled "Crime Scene."
2. Using the magnifying glass, compare the cloth from the crime scene to cloth from the suspects' clothing. (Be careful not to mix them up!) Look for:
  - a. colour
  - b. texture (rough or smooth?)
  - c. shape of individual fibres (round like spaghetti or flat like linguini?)
  - d. thickness of individual fibres
3. Write down your observations and decide which suspect most likely left the scrap of cloth at the crime scene.

**Advanced Analysis:**

1. Label one of the glass dishes "Vinegar" and the other "Acetone." Pour a little vinegar into the first dish and a little nail polish remover into the second one.
2. Cut each fabric sample into two pieces (three pieces if you are planning to do the "No Coming Back From This" analysis below). Wearing rubber gloves, place one piece of each sample into the vinegar and the other piece into the acetone. Let them soak for five minutes. (Note: if your samples all look very similar, you may want to soak them individually so you don't mix them up.)

3. Using tweezers, remove the cloth samples from the vinegar, rinse them with plain water and place them on a piece of paper towel labeled "Vinegar" to dry. Do the same for the cloth samples in the acetone, but label the paper towel "Acetone."
4. Closely examine the cloth samples. Did they change in any way (shrink, change colour)?
5. Write down your observations and decide which suspect most likely left the scrap of cloth at the crime scene.

#### **No Coming Back From This Analysis:**

**Safety first!** Tie back long hair, remove loose clothing and roll up long sleeves. The tongs or forceps will get hot, so don't touch them with your bare hands. Place any hot, burning or smoldering cloth samples on a heat-proof surface and make sure they are completely cold before you throw them out.

1. Light the candle or Bunsen burner.
2. Using oven mitts and tongs, hold a cloth sample close to (but not touching) the candle flame. Does the cloth melt, ignite or curl?
3. Touch the cloth sample to the edge of the flame. Does it ignite quickly or slowly? Does it sputter, melt or drip?
4. Remove the cloth sample from the flame. Does it continue to burn, glow and smolder or does it extinguish itself?
5. What do you observe?
  - a. If the cloth sample smells like burning hair, it is probably silk or wool.
  - b. If the cloth sample smells like burning paper, it is probably cotton, linen, cupra rayon or viscose rayon.
  - c. If the cloth sample melts and forms beads, it is probably acetate, polyester, Dacron or nylon.
6. Write down your observations and decide which suspect most likely left the scrap of cloth at the crime scene.

## 5.5 Unknown Powders and Liquids

Sometimes investigators discover powders or liquids at a crime scene and need to find out what they are. Powders may be illegal drugs; liquids might be fuels or accelerants used in arson. Forensic investigators use chemistry to test unknown powders or liquids and compare the results to known powders and liquids to figure out what the unknown substance is. In this experiment, you test several known white powders, then challenge your partner to identify an unknown one using the test results.

A note on scientific methods: In this experiment, you touch and smell the white powders. It's okay to do that in this case, because all the powders are everyday things that are completely harmless. However, in a real forensic investigation (or any real chemistry experiment) you would *never* touch or smell an unknown substance—if you don't know what it is, you don't know if it is toxic or corrosive!

### What you need:

- baking soda
- cornstarch
- salt
- sugar
- measuring spoons
- four sheets of black construction paper
- magnifying glass
- white crayon or chalk
- sheet of white paper
- eyedropper
- water
- four small jars
- iodine solution
- dish towel
- vinegar
- pencil or pen
- powder analysis chart (an example follows the instructions)

### What to do:

Complete the appearance, texture and smell activities before opening the vinegar and iodine bottles.

1. Place one-quarter teaspoon (1 ml) of the four white powders on a sheet of black construction paper. Label the powders with the white chalk or crayon.
2. Study the powders with the magnifying glass. Examine what each powder looks like. How would you describe the powder's shape? Does it have large or small grains? Write your observations in the "Appearance" column of the powder analysis chart.
3. Rub a pinch of each powder between your fingers. Describe how each powder feels in the "Texture" column of the chart.
4. Determine if there is a smell to any of the powders. Write your observations in the "Smell" column of the chart.
5. Using the eyedropper, place a drop of water on each powder. Examine what happens. Do the powders dissolve? Is there a reaction? Write your observations in the "Reaction to Water" column.
6. Place one-half teaspoon (2 ml) of each powder in a separate jar. Add 2 drops of iodine to each jar using the eyedropper. Record what happens in the "Reaction to Iodine" column. Iodine should be handled with care.
7. Rinse the jars and dry them thoroughly, then repeat Step 6 using vinegar instead of iodine. Record what happens in the "Reaction to Vinegar" column.

8. Once you have analyzed and recorded the results for each known powder, ask your partner to leave the area. Place one of the four powders onto a new sheet of black construction paper, but don't label it. Call your partner back and see if she can identify the unknown powder using the results in your chart. Then switch jobs and see if you can identify a powder selected by your partner.

**Powder Analysis Chart:**

<b>Powder</b>	<b>Appearance</b>	<b>Texture</b>	<b>Smell</b>	<b>Reaction to Water</b>	<b>Reaction to Iodine</b>	<b>Reaction to Vinegar</b>
Baking Powder						
Cornstarch						
Salt						
Sugar						

## 5.6 Footprints

Footprints can be very useful evidence in a crime scene investigation. By examining footprints, investigators can determine what kind of shoes the perpetrator was wearing. They can also figure out the approximate height and weight of the perpetrator or whether he or she walks with a limp.

### 5.6.1 Shoes and Shoe Prints

Look at a footprint and at the shoes of several suspects to identify which suspect left a footprint at the crime scene.

#### **What you need:**

- shoes taken from two or more suspects
- poster paint and paper or a container of soft dirt

#### **Advance preparation:**

1. Gather several shoes of different types and sizes (one shoe for each suspect). The more alike the shoes are, the more challenging this activity will be.
2. Use one of the shoes to create a footprint by stepping in wet poster paint and then onto a sheet of paper, or by pressing the shoe into a container of soft dirt. Either way, make sure the footprint is clear and shows lots of tread detail. This is the footprint found at the crime scene.

#### **What to do:**

1. Closely examine the crime scene footprint. What kind of shoe made it (running shoe, high-heeled shoe, etc)? Was it a big shoe or a small shoe? Are there any identifying features in the tread, such as a brand name, logo, damaged area or unique tread pattern?
2. Examine the shoes taken from the suspects and compare them to the footprint from the crime scene. Which shoe most closely matches the footprint? If the footprint was in soft dirt or in a liquid like paint, can you see traces of the dirt or paint on the shoe?
3. Decide which suspect most likely left the footprint at the crime scene.

## 5.6.2 Comparing Height and Foot Size

Do this experiment to find out how a person's foot size compares to their height.

### What you need:

- several adults who don't mind being measured
- chalk or masking tape
- measuring tape
- paper and pen or pencil
- height estimation chart (an example follows the instructions)
- calculator, if you really need it, but challenge yourself to do the math without it!

### What to do:

1. Ask the adults to remove their shoes and stand against a wall, with their heels firmly against the wall.
2. Mark each adult's height by placing a chalk mark or a piece of masking tape on the wall at the top of the head.
3. Mark the length of each adult's left foot by placing a chalk mark or a piece of masking tape on the floor at the tip of the longest toe on the left foot.
4. Ask each adult to step away from the wall, then measure along the floor from the wall to the mark you made on the floor. It doesn't matter whether you use centimetres or inches, as long as you use the same thing for all the measurements. Record this measurement in the "Foot Length" column of the height estimation chart.
5. Measure up the wall from the floor to the mark you made on the wall. Record this measurement in the "Height" column of the height estimation chart.
6. Divide the length of each adult's foot by his or her height. Multiply that answer by 100. Write the final number on your chart.
7. The final number should be about 15 for each adult you've measured. This indicates that the length of an adult's foot is about 15% of his or her height. (This ratio doesn't always hold for kids, though, since the proportion of body parts in growing children is different depending on their age.)

### Height Estimation Chart

Adult's Name	Foot Length	Height	(Foot Length ÷ Height) X 100

### 5.6.3 How Tall is the Perpetrator?

In this activity, you estimate the height of a perpetrator from a footprint left at the crime scene.

**What you need:**

- footprint from the crime scene (see “Advance Preparation” below)
- measuring tape or ruler
- calculator, if you really need it, but challenge yourself to do the math without it!

**Advance preparation:**

1. Make a footprint. There are several ways to do this:
  - Draw a simple outline of your foot on a sheet of paper.
  - Step into poster paint then onto a sheet of paper.
  - Step into a container of soft dirt.

**What to do:**

1. Measure the footprint from the crime scene.
2. Divide the measurement by 15.
3. Multiply the answer from step 2 by 100. The answer is the approximate height of the person who left the footprint behind. This calculation is more accurate if the perpetrator was barefoot; if he or she was wearing shoes, it should still be pretty close as long as the shoes fit properly.

## 5.7 DNA and Forensic Identification

How do forensic scientists identify people (or other living things) using DNA?

DNA is the genetic material that determines your physical characteristics—for example, whether your eyes are brown like your dad's or blue like your mom's. All plants and animals, from simple bacteria to complex animals like humans, have DNA. In fact, the DNA of all living things is very similar, no matter what species it comes from. The genetic material of humans, for example, is 98% identical to that of chimpanzees.

Within a species, DNA is even more similar. Even though you and your neighbour might look very different on the outside, your DNA is extremely similar. In fact, only about one-tenth of one percent of your DNA accounts for all the differences between how you and your neighbour look (see “How Alike Are We?” on page 37). To identify individual people, forensic scientists have to examine the parts of the DNA that vary from person to person. They look at many different locations on the individual's DNA and use the data to create a DNA profile, also called a DNA fingerprint, of the individual.

Because individuals of the same species all have such similar DNA, forensic scientists have to look at several different locations on the DNA when they create a DNA profile (see “DNA Profiling and Criminal Cases”). If they only look at only one or two locations, there is a good chance that another individual will have the same profile. Forensic scientists use four or five locations so that the chances are extremely small that another individual has the same DNA profile for those same locations.

Forensic scientists use DNA profiling for many different kinds of investigations, including:

- identifying potential suspects whose DNA may match evidence left at crime scenes
- exonerating people who have been wrongly accused of crimes
- identifying the victims of crimes or catastrophes like earthquakes
- establishing paternity and other family relationships
- identifying endangered and protected species to help wildlife officials protect animals or prosecute poachers
- detecting bacteria and other organisms that may pollute air, water, soil and food
- matching organ donors with recipients in organ transplant programs
- determining the origin of seed or livestock breeds
- testing consumable products, such as caviar and wine, to authenticate their type and value

### 5.7.1 DNA Profiling and Criminal Cases

In criminal cases, DNA profiling generally involves obtaining samples of DNA from the crime scene evidence (blood, bone, hair and other body tissues and products) and from a suspect. Forensic scientists analyze the sample DNA by combining it with special pieces of DNA that act as probes. Each probe is designed to bind to a specific part of the sample DNA. When several probes bind to a DNA sample, they create a distinctive pattern called a DNA profile. Forensic scientists compare these DNA profiles to determine whether the suspect's DNA profile matches the DNA profile from the crime scene evidence.

If the profiles don't match, the suspect did not contribute the DNA at the crime scene.

If the profiles match, the suspect *may* have contributed the DNA found at the crime scene. There is still a chance that someone else has the same DNA profile for a particular probe set (called a coincidental match).

Using more probes in the DNA analysis increases the odds that the profile is unique, reducing the chances of a coincidental match. A marker by itself usually is not unique to an individual; however, if the two DNA samples are alike at four or five regions, odds are great that the samples are from the same person. However, using more probes means that the testing takes longer and costs more. Four to six probes are recommended.

This raises an important question: When you are deciding whether a person is innocent or guilty of a crime, how certain do you have to be that the correct person has been identified? Should a jury convict the suspect if there is even a tiny chance that the DNA evidence has shown a coincidental match instead of identifying the real criminal?

Many judges consider this to be something for a jury to consider along with other evidence in the case. Experts point out that DNA forensic technology is much more reliable than eyewitness accounts, where suspects are correctly identified only about half the time.

### 5.7.2 How Alike Are We?

All human beings have very similar DNA. Try this simple activity to find out how much of your DNA is the same as everyone else's and how much is different.

#### What you need:

- cooked macaroni noodles (or gumdrops, cooked peas or similar items)
- sharp knife—be careful using it!

#### What to do:

1. Count out 100 macaroni noodles and put them in a pile. This pile of macaroni represents all of your DNA.
2. Pull one noodle out of the pile and cut it into ten pieces. Make the pieces as equal as you can.
3. Put one of the little pieces to the side by itself and put the other nine pieces back onto the pile of macaroni.

The pile of macaroni represents the amount of your DNA that is the same as every other human being's DNA. It's the genetic material that makes you very similar to everybody else. For example, you and your neighbour both have arms and legs, skin, hair and eyes. The one little piece of macaroni that you set aside—one-tenth of one percent of the macaroni—represents the DNA that makes you different from everybody else: maybe your arms and legs are shorter than your neighbour's; perhaps you have brown hair and eyes and she's a blue-eyed blonde.

With a partner, make a list of all the characteristics you share with your partner (you have a brain, you have two eyes, you smile when you're happy and so on). Make another list of how each of these things is different between you and your partner (your brain is good at math and your friend's is good at making up poetry; your eyes are blue and your friend's are brown; you have dimples when you smile but your partner doesn't).

### 5.7.3 DNA Extraction

Follow the steps below to extract DNA from strawberries. You can try these steps to purify DNA from lots of other living things, too. Once you've succeeded with strawberries, try again with oatmeal or kiwis. Which foods give you the most DNA?

#### What you need:

- measuring cup
- measuring spoons
- rubbing alcohol
- 1/2 teaspoon salt
- 1/3 cup water
- 1 tablespoon Dawn dishwashing detergent
- glass or small bowl
- cheesecloth
- funnel
- tall drinking glass
- 3 strawberries (green tops removed)
- resealable plastic freezer bags
- test tube or small glass jar (like the kind spices come in)
- bamboo skewer (find them at the grocery store)

#### What to do:

1. Chill the rubbing alcohol in the freezer. You'll need it later.
2. Mix the salt, water and Dawn detergent in a glass or small bowl. Set the mixture aside. This is your extraction liquid.
3. Line the funnel with the cheesecloth and put the funnel's tube into the glass.
4. Put the strawberries in the plastic bag and push out all the extra air. Seal it tightly. With your fingers, squeeze and smash the strawberry mixture for two minutes.
5. Add 3 tablespoons of the extraction liquid you made in Step 2 to the strawberries in the bag. Push out all the extra air and reseal the bag. Squeeze the strawberry mixture with your fingers for one minute.
6. Pour the strawberry mixture from the bag into the funnel. Let it drip into the glass until there is no liquid left in the funnel. Throw away the cheesecloth and the strawberry pulp inside.
7. Pour the contents of the glass into the test tube or small glass jar so it is one-quarter full.
8. Tilt the test tube or jar and very slowly pour the cold rubbing alcohol down the side. The alcohol should form a layer on top of the strawberry liquid. (Don't let the alcohol and strawberry liquid mix. The DNA collects between the two layers!)
9. Dip the bamboo skewer into the test tube where the alcohol and strawberry layers meet. Pull up the skewer. The whitish, stringy stuff is DNA containing strawberry genes!

#### How it works:

When you smash up the strawberries, you are separating the strawberry cells from one another. The detergent breaks down the cell membrane (a kind of sack that surrounds

each cell) and breaks open the cell nucleus, which is where the DNA is. The salt helps the DNA precipitate (chemist lingo for “come out of the mixture.”)

The alcohol lets you separate the DNA from the other remnants of the strawberry cells. Alcohol is less dense than water, so it floats on top of the watery pea soup. The proteins and other heavy parts of the strawberry cells sink to the bottom of the test tube, while the lighter DNA rises up into the alcohol.

#### **5.7.4 Bar Code DNA**

In this activity, you use bar codes (UPC symbols) from household products to simulate DNA samples taken from a crime scene and from the suspects.

**What you need:**

- bar codes from two or more different products. These bar codes represent the suspects’ DNA samples.
- bar code that is similar to one of the suspects’ bar codes. This represents DNA that was taken from the crime scene.

Note: For older girls, make this activity more challenging by choosing very similar bar codes—e.g., from different varieties of Catelli pasta. For younger girls, use different bar codes for each of the suspects and make the crime scene bar code identical to one of them.

**Advance preparation:**

1. Label each bar code with “Crime Scene,” “Suspect #1,” etc.
2. Remove the numbers from the bottom of the bar code, either by whitening them out or cutting them off, so that only the pattern of lines remains.
3. Make copies of the bar codes for each girl or small group of girls.

**What to do:**

1. Give each girl or group of girls a copy of the suspects’ DNA (bar codes) and of the DNA taken from the crime scene.
2. Ask the girls to compare the bar codes and decide which suspect was most likely at the crime scene.

## 6 Crime Scene Investigation: A (Sort Of) Instant Meeting

You can combine many of the activities in this booklet into one big Crime Scene Investigation event. Round up a few suspects, create a crime scene and let the girls analyze the evidence to decide who the guilty party is! Use the crime scene scenario below or create your own.

This scenario includes a lot of different kinds of evidence, all of which can be analyzed using the procedures described in the “Forensic Science Activities” section on page 20. It would take a lot of time to analyze all of this evidence. To make this investigation fit into the time you have available or to adapt it to the interests and abilities of the girls, feel free to cut out some of the types of evidence. On the other hand, if you are doing this investigation at a camp or similar long-lasting event, you may want to use it all.

A few tips for a successful CSI event:

- Even in the hands of forensic experts, crime scene evidence can be misleading and give conflicting or inconclusive results. Try to have at least three different kinds of evidence to analyze so that you have a better chance of narrowing down the suspect list to one single perpetrator.
- Keep the interests, abilities and sensitivities of your girls in mind when you are planning your crime scene.
- More suspects make the game more challenging, but also more time consuming. Unless your girls are really eager, limit yourself to three or four suspects.
- If you are working with a very large group, consider splitting it into smaller teams and having each team analyze one or two types of evidence (rather than having all the girls analyze all the evidence) and present their findings to the rest of the group.

### 6.1 The Crime Scene

The unit’s cookies have been stolen! Guider Sally arrived home to find that her kitchen, where the cookies were stored, has been broken into and all the cookies are gone. When police arrive, they cordon off the area and look for evidence. They find that the thief has left very clear footprints in the soft soil of the flowerbed outside the kitchen window. The window itself has been smashed and there is glass all over the kitchen floor. There are a few blood spatters as well; the thief evidently cut himself or herself while breaking the window. On closer inspection, the police also find a small scrap of fabric, presumably torn from the thief’s clothing, caught on one of the glass shards still in the windowpane.

Inside the kitchen, the police find a drinking glass with some liquid in it and a piece of cheese that has had a bite taken out of it. A bit of white powder has been spilled on the floor. There are a few stray hairs near where the cookies were stacked, next to a note, written in black marker, that reads, “Good-bye and thanks for all the cookies!”

After questioning the neighbours, the police have identified three suspects who were in the area at about the time the crime took place:

- Mr. Crustie, a neighbourhood baker
- Ms. Pip C. Kola, a soft-drink distributor
- Miss Billie Gote, a local cheese maker

## 6.2 Advance Preparation

The materials needed and the advance preparation required depend on which evidence you are planning to use. Please refer to the “Forensic Science Activities” section starting on page 20 for details.

## 6.3 What To Do

1. Read the crime scene description to the girls. Tell them they are part of the team of forensic scientists assigned to the case. Their job is to analyze the evidence to determine which of the suspects committed this terrible crime.
2. Use the procedures described in the “Forensic Science Activities” section starting on page 20 to analyze the evidence:
  - a. Compare the writing on the note from the crime scene with handwriting samples provided by the suspects (see “Handwriting Analysis” on page 20).
  - b. Do ink chromatography to compare the ink on the note from the crime scene with ink from pens taken from the suspects (see “Ink Chromatography” on page 22).
  - c. Test the glass for fingerprints and compare them to fingerprints provided by the suspects (see “Lifting Fingerprints as Evidence” on page 24).
  - d. Compare the bite mark on the cheese with dental impressions taken from the suspects (see “Dental Impressions” on page 26).
  - e. Compare the scrap of fabric from the crime scene with the suspects’ clothing (see “Hairs and Fibres” on page 28).
  - f. Analyze the white powder to find out what it is (see “Unknown Powders and Liquids” on page 31).
  - g. Compare the footprint from the crime scene to the shoes the suspects are wearing and estimate the height of the thief (see “Footprints” on page 33).
  - h. Compare the DNA from the blood spatters at the crime scene with a DNA sample provided by the suspects (see “Bar Code DNA” on page 39).
3. When you have analyzed all the evidence, summarize your results and make an accusation of one of the suspects.

## 7 Guest Speakers and Field Trips

Why spend hours trying to turn yourself into a forensic expert for this challenge when you can talk to a real expert? Guest speakers and field trips can add interest to many of the activities suggested in this booklet. Here are some ideas to get you started:

- Invite a local police officer to talk to your group about local laws, law enforcement or street safety.
- Ask your fire department to do a presentation on arson investigation.
- Contact your RCMP detachment to see if they have a forensics department; they may be able to set up a crime scene investigation activity for your group.
- Invite a lawyer or judge to teach your group about the BC legal system and court procedures.
- Take a tour of a police station.
- Visit a local college or university lab for some hands-on chemistry, biochemistry or physics activities.
- Tour the local courthouse and hold your mock trial in a real courtroom.
- Visit a hospital lab to find out how lab technicians test blood and other patient samples for illnesses.
- Hold a career awareness event and invite police officers, lawyers, forensic investigators, judges, lab technicians and chemists (and anyone else you think fits into the theme) to talk about what they do and how they got into their field.

A few tips for a successful event:

- Presentations that include hands-on activities or games are generally more successful, particularly for younger girls, than lengthy lectures.
- If some of your girls are especially sensitive about particular subjects, make sure your guests are aware of this.

## 8 Forensic Science in Real Life

Crime scene investigations don't just happen on TV; forensic science is a real field of study. Check out the one or more of the real-life investigations below (or pick your own) and see what you can find out about them. For example:

- What role did forensic evidence play in the investigation?
- What forensic science techniques did the investigators use?
- Was there any controversy about any of the evidence?
- Were there any questions about the case that could not be answered by forensic evidence?

Present what you find out in the form of a play or mock trial, a poster or collage or any other format that is appropriate.

### 8.1 Reality TV?

Think real-life forensic science is just like what you see on TV? Think again! Popular TV shows, as exciting as they are, actually misrepresent the field of forensic science. Find out how forensic investigations in real life are different from what you see on TV.

### 8.2 The Love Bug

The “Love Bug” was one of the most notoriously destructive computer viruses ever created. The virus showed up as an e-mail attachment with the subject line “I Love You.” When the file was opened, the virus sent itself to every contact in the computer’s e-mail address book. It spread all over the world in two hours—three times faster than any other virus at that time—shutting down servers, bank networks, government systems and corporate servers. Eventually investigators managed to trace the virus back to a Filipino student named Onel de Guzman. When police searched de Guzman’s apartment, they found disks and other materials proving he had helped create the virus. At the time (May 2000), there was no law in the Philippines against computer hacking. A new law had been introduced by June, but by then it was too late to apply it to the “Love Bug” case.

### 8.3 The Hitler Diaries

In 1983, the German news magazine *Stern* published excerpts from diaries supposedly written by Adolf Hitler. The magazine paid 10 million marks (about 8 million of today’s Canadian dollars) for the diaries, which had been deemed authentic by a number of experts in World War II history. Within two weeks, the diaries were revealed to be fakes that had been printed on modern paper and contained many historical inaccuracies.

## 8.4 A 5000-Year-Old Murder

In September 1991, an Austrian couple was out hiking in the Alps when they came across a human body half buried in ice. Thinking it was a hiker or skier who had had an accident, they called the authorities. It didn't take long to discover that the body was actually over 5000 years old! Archaeologists named him Ötzi the Iceman, after the region where he was found, and initially thought he had died of exposure in the high mountain area. In June 2001, though, forensic investigators found new evidence that pointed to another cause of death: murder.

## 8.5 A Strange Union of Fake-ness

In the 1950s and 1960s, the forger Elmyr de Hory sold hundreds of forged paintings, supposedly by masters such as Picasso and Matisse, to galleries, museums and collectors all over the world. In 1969, a biography of de Hory was published in the book *Fake* by Clifford Irving. Ironically, Irving was later convicted of forging another biography, this time a fake autobiography of Howard Hughes. The 1974 film *F for Fake* wove both these stories, and others, into a documentary on authenticity and the basic value of art. *F for Fake* was the last major film completed by Orson Welles—who in 1938 had gained notoriety for duping the public into believing an actual Martian invasion was taking place with his radio adaptation of H.G. Wells' *War of the Worlds*.

## 8.6 The Kidnapping of Charles Lindbergh Jr.

On March 1, 1932, Charles Lindbergh Jr., the infant son of the famous aviator, was kidnapped. The kidnapers demanded a ransom of \$50,000, which they received, but they didn't return the baby. Charles Jr. was found dead two months later. The crime was not solved for nearly three years.

## 8.7 Wolves Versus Elk Hunters

Many people in Idaho are strongly opposed to a program that reintroduced wolves to wilderness areas in Idaho, because they blame the wolves for drops in the population of elk and deer. When poisoned meatballs were found in the area, investigators from the National Fish and Wildlife Forensics Laboratory in Ashland, Oregon suspected that someone was trying to kill the wolves. The investigators collected evidence: the meatballs and the poison, bootprints, tire tracks. The evidence pointed to Tim Sundles, an elk hunter and an outspoken critic of the wolf reintroduction program. Sundles had even threatened to shoot anyone who tried to stop him from killing wolves. More evidence from Sundles's garage tied him conclusively to the crime.

## 8.8 Was Napoleon Poisoned?

The French Emperor Napoleon Bonaparte died in 1821 on the island of St. Helena, where he was imprisoned by the British after losing the Battle of Waterloo. For 180 years, everyone believed that he died because of a stomach ulcer. In 2001, however, forensic studies suggested that he had actually been slowly poisoned—a forensic scientist from Strasbourg found that the levels of arsenic in hair taken from Napoleon's head after his death were as much as 38 times higher than normal. That was a controversial theory, though, and new studies suggest that it might not be true after all.

## 9 Program Connections

Wondering how the activities in the CSI Challenge fit into the rest of your unit's program? The tables below outline program connections for each branch. If you find other connections to your program, please feel free to give your girls credit for them (and email the Program Committee so we can update these tables!)

### 9.1 Spark Program Connections

Section and Activity	Spark Program Connections
<b>2 Puzzles</b>	
2.1 Spot the Differences 2.2-2.4 CSI Word Searches 2.5 Super-Sleuth Maze 2.6 CSI Crossword Puzzle	No specific program connection
<b>3 Observation Games</b>	
3.1 Kim's Game 3.2-3.5 How Good a Witness Are You? 3.6 I Spy... 3.7 What Just Happened?	No specific program connection
3.8 What's That Noise? 3.9 What's That Smell? 3.10 What's That Texture?	Exploring and Experimenting Keeper
<b>4 Arts, Crafts and Drama</b>	
4.1 CSI Colouring Pages	No specific program connection
4.2 Fingerprint Art 4.3 Shrink Art CSI Crafts 4.4 CSI Hat Crafts 4.5 Make Your Own Detective Kit 4.6 What Is This? 4.7 CSI Photography	Exploring and Experimenting Keeper
4.8 Mock Trial 4.9 Murder (or not) Mystery Game 4.10 Mystery Reading 4.11 Mystery Movie Night	May not be age-appropriate for Sparks

<b>Section and Activity</b>	<b>Spark Program Connections</b>
<b>5 Forensic Science Activities</b>	
5.1 Messages, Ransom Notes and Other Documents 5.2 Fingerprints 5.3 Dental Impressions 5.4 Hairs and Fibres 5.5 Unknown Powders and Liquids 5.6 Footprints 5.7 DNA and Forensic Identification	Exploring and Experimenting Keeper
<b>6 Crime Scene Investigation</b>	Exploring and Experimenting Keeper
<b>7 Guest Speakers and Field Trips</b>	No specific program connection
<b>8 Forensic Science in Real Life</b>	No specific program connection

## 9.2 Brownie Program Connections

<b>Section and Activity</b>	<b>Brownie Program Connections</b>
<b>2 Puzzles</b>	
2.1 Spot the Differences 2.2-2.4 CSI Word Searches 2.5 Super-Sleuth Maze 2.6 CSI Crossword Puzzle	No specific program connection
<b>3 Observation Games</b>	
3.1 Kim's Game 3.2-3.5 How Good a Witness Are You? 3.6 I Spy... 3.7 What Just Happened?	No specific program connection
3.8 What's That Noise?	Key To STEM: Interest badge "S Stands For Sound," Part A
3.9 What's That Smell? 3.10 What's That Texture?	Key To STEM: Create special interest badge on CSI

<b>Section and Activity</b>	<b>Brownie Program Connections</b>
<b>4 Arts, Crafts and Drama</b>	
4.1 CSI Colouring Pages	No specific program connection
4.2 Fingerprint Art 4.3 Shrink Art CSI Crafts 4.4 CSI Hat Crafts 4.5 Make Your Own Detective Kit 4.6 What Is This? 4.7 CSI Photography 4.8 Mock Trial 4.9 Murder (or not) Mystery Game 4.10 Mystery Reading 4.11 Mystery Movie Night	Key To STEM: Create special interest badge on CSI
<b>5 Forensic Science Activities</b>	
5.1 Messages, Ransom Notes and Other Documents 5.2 Fingerprints 5.3 Dental Impressions 5.4 Hairs and Fibres 5.5 Unknown Powders and Liquids 5.6 Footprints 5.7 DNA and Forensic Identification	Key To STEM: Create special interest badge on CSI
<b>6 Crime Scene Investigation</b>	Key To STEM: Create special interest badge on CSI
<b>7 Guest Speakers and Field Trips</b>	Key To STEM: Part 2—People in Science
<b>8 Forensic Science in Real Life</b>	Key To STEM: Create special interest badge on CSI

### 9.3 Guide Program Connections

Section and Activity	Guide Program Connection
<b>2 Puzzles</b>	
2.1 Spot the Differences 2.2-2.4 CSI Word Searches 2.5 Super-Sleuth Maze 2.6 CSI Crossword Puzzle	Beyond You: Try New Things #6
2.2-2.4 CSI Word Searches 2.5 Super-Sleuth Maze 2.6 CSI Crossword Puzzle	Beyond You: Try New Things #6
<b>3 Observation Games</b>	
3.1 Kim's Game 3.2-3.5 How Good a Witness Are You?	Beyond You: Try New Things #6
3.6 I Spy...	No specific program connection
3.7 What Just Happened? 3.8 What's That Noise? 3.9 What's That Smell? 3.10 What's That Texture?	Bodyworks Badge #1
<b>4 Arts, Crafts and Drama</b>	
4.1 CSI Colouring Pages 4.2 Fingerprint Art 4.3 Shrink Art CSI Crafts 4.4 CSI Hat Crafts	Discovering You : Discovering Your Creativity #3
4.5 Make Your Own Detective Kit 4.6 What Is This? 4.7 CSI Photography	Beyond You: Try New Things #4 and #6
4.8 Mock Trial 4.9 Murder (or not) Mystery Game	Discovering You : Discovering Your Creativity #3
4.10 Mystery Reading	Readers Badge #3 or #6
4.11 Mystery Movie Night	Discovering You: Discovering What's Important to You #6 You and Others: Learn How to Plan #1 or #6
<b>5 Forensic Science Activities</b>	
5.1 Messages, Ransom Notes and Other Documents	
5.1.1 Handwriting Analysis	Bodyworks #1 Beyond You: Try New Things #4 and #6

<b>Section and Activity</b>	<b>Guide Program Connection</b>
5.1.2 Ink Chromatography	Science Badge #4 Chemistry Badge #4 or #8 Beyond You: Try New Things #4 and #6
5.2 Fingerprints	
5.2.1-5.2.2 Looking at Your Own Fingerprints 5.2.3 Lifting Fingerprints as Evidence	Beyond You: Try New Things #4 and #6 Bodyworks Badge #6
5.3 Dental Impressions	
5.3.1-5.3.2 Making Dental Impressions 5.3.3 Using Dental Impressions to Identify Suspects	Beyond You: Try New Things #4 and #6 Bodyworks Badge #6
5.4 Hairs and Fibres 5.5 Unknown Powders and Liquids	Beyond You: Try New Things #4 and #6 Chemistry Badge #2 or #8
5.6 Footprints	
5.6.1 Shoes and Shoe Prints	Beyond You: Try New Things #4 and #6
5.6.2 Comparing Height and Foot Size 5.6.3 How Tall is the Perpetrator?	Beyond You: Try New Things #4 and #6 Bodyworks Badge # 1
5.7 DNA and Forensic Identification	
5.7.1 DNA Profiling and Criminal Cases	Beyond You: Try New Things #4 and #6 Science Badge #2
5.7.2 How Alike Are We?	Beyond You: Try New Things #4 and #6
5.7.3 DNA Extraction	Beyond You: Try New Things #4 and #6 Chemistry Badge #2 or #8 Science Badge #2 and #4
5.7.4 Bar-Code DNA	Beyond You: Try New Things #4 and #6
<b>6 Crime Scene Investigation</b>	Please see program connections for the individual forensic science activities you include in this investigation.
<b>7 Guest Speakers and Field Trips</b>	Discovering You: Discovering What's Important to You #4 Science Badge #1, #2 and #6
<b>8 Forensic Science in Real Life</b>	Beyond You: Try New Things #4 and #6

## 9.4 Pathfinder Program Connections

Section and Activity	Pathfinder Program Connections
<b>2 Puzzles</b>	
2.1 Spot the Differences 2.2-2.4 CSI Word Searches	Puzzle Me #1 or #2
2.5 Super-Sleuth Maze	Secret Agent 007 #7
2.6 CSI Crossword Puzzle	Puzzle Me #1 or #2
<b>3 Observation Games</b>	
3.1 Kim's Game 3.2-3.5 How Good a Witness Are You?	Secret Agent 007 #4
3.6 I Spy...	Puzzle Me #1 or #2
3.7 What Just Happened? 3.8 What's That Noise? 3.9 What's That Smell? 3.10 What's That Texture?	Puzzle Me #6
<b>4 Arts, Crafts and Drama</b>	
4.1 CSI Colouring Pages 4.2 Fingerprint Art 4.3 Shrink Art CSI Crafts 4.4 CSI Hat Crafts 4.5 Make Your Own Detective Kit	The Arts from A to Z #7
4.6 What Is This? 4.7 CSI Photography	Puzzle Me #6
4.8 Mock Trial	The Arts from A to Z #5
4.9 Murder (or not) Mystery Game	Secret Agent 007 #5
4.10 Mystery Reading	Secret Agent 007 #3
4.11 Mystery Movie Night	Movie Mania #8
<b>5 Forensic Science Activities</b>	
5.1 Messages, Ransom Notes and Other Documents	
5.1.1 Handwriting Analysis	Everything Comes from STEM #1 and #6
5.1.2 Ink Chromatography	Everything Comes from STEM #1, #6 and #7

<b>Section and Activity</b>	<b>Pathfinder Program Connections</b>
5.2 Fingerprints	
5.2.1-5.2.2 Looking at Your Own Fingerprints 5.2.3 Lifting Fingerprints as Evidence	Secret Agent 007 #1
5.3 Dental Impressions	
5.3.1-5.3.2 Making Dental Impressions 5.3.3 Using Dental Impressions to Identify Suspects	Everything Comes from STEM #6
5.4 Hairs and Fibres	Everything Comes from STEM #1 and #7
5.5 Unknown Powders and Liquids	Everything Comes from STEM #1 and #6
5.6 Footprints	
5.6.1 Shoes and Shoe Prints	Everything Comes from STEM #1 and #6
5.6.2 Comparing Height and Foot Size 5.6.3 How Tall is the Perpetrator?	Everything Comes from STEM #1 and #3
5.7 DNA and Forensic Identification	
5.7.1 DNA Profiling and Criminal Cases	Everything Comes from STEM #1 and #6
5.7.2 How Alike Are We? 5.7.3 DNA Extraction	Everything Comes from STEM #6
5.7.4 Bar-Code DNA	Everything Comes from STEM #1 and #6
<b>6 Crime Scene Investigation</b>	Please see program connections for the individual forensic science activities you include in this investigation.
<b>7 Guest Speakers and Field Trips</b>	Secret Agent 007 #2 and #3 Your Dream Career #3 Everything Comes from STEM #4
<b>8 Forensic Science in Real Life</b>	Secret Agent 007 #3

## 9.5 Ranger Program Connections

Section and Activity	Ranger Program Connections
General program connections that apply to all challenge activities	Your Future #13: Gender Roles Your Future #15: What's For You? Your Future #27: Safety First Leadership and Management #13: Meeting Themes Leadership and Management #21: Make Learning Fun Leadership and Management #23. Reach For It Celebrate Guiding #1: Modern Women, Modern Guiding Celebrate Guiding #17: Get Up and Have Fun
<b>2 Puzzles</b>	
2.1 Spot the Differences	Explore Your Creativity #14: Picture Perfect
2.2-2.4 CSI Word Searches 2.5 Super-Sleuth Maze 2.6 CSI Crossword Puzzle	No specific program connection
<b>3 Observation Games</b>	
3.1 Kim's Game	Leadership and Management #19: How Do You Learn?
3.2-3.5 How Good a Witness Are You?	Leadership and Management #9: Barriers to Effective Communication
3.6 I Spy...	Explore Your Creativity #9: Design 101
3.7 What Just Happened?	Leadership and Management #9: Barriers to Effective Communication
3.8 What's That Noise? 3.9 What's That Smell? 3.10 What's That Texture?	Leadership and Management #19: How Do You Learn?
<b>4 Arts, Crafts and Drama</b>	
4.1 CSI Colouring Pages	Global Awareness #23: Right On!
4.2 Fingerprint Art	Explore Your Creativity #1: Artists and the Natural World Explore Your Creativity #29: Art All Around
4.3 Shrink Art CSI Crafts	Explore Your Creativity #28: The Science of Art
4.4 CSI Hat Crafts	Explore Your Creativity #29: Art All Around
4.5 Make Your Own Detective Kit	Leadership and Management #14: File It
4.6 What Is This?	Explore Your Creativity #14: Picture Perfect

<b>Section and Activity</b>	<b>Ranger Program Connections</b>
4.7 CSI Photography	Explore Your Creativity #13: Photo Essay Explore Your Creativity #14: Picture Perfect
4.8 Mock Trial	Global Awareness #9: That's Illegal? Global Awareness #10: Women and the Law Leadership and Management #8: What You Say Your Future #12: Know Your Rights Your Future #27: Safety First
4.9 Murder (or not) Mystery Game	Leadership and Management #8: What You Say
4.10 Mystery Reading	Explore Your Creativity #21: Book Club Explore Your Creativity #23: Can Lit
4.11 Mystery Movie Night	Explore Your Creativity #2: The Arts as a Career Explore Your Creativity #4: Hollywood North Explore Your Creativity #7: Documenting Reality
<b>5 Forensic Science Activities</b>	
5.1 Messages, Ransom Notes and Other Documents	
5.1.1 Handwriting Analysis	Global Awareness #16: Talk About It
5.1.2 Ink Chromatography	Explore Your Creativity #28: The Science of Art
5.2 Fingerprints	
5.2.1-5.2.2 Looking at Your Own Fingerprints	Healthy Living #27: Going Natural
5.2.3 Lifting Fingerprints as Evidence	Global Awareness #10: Women and the Law
5.3 Dental Impressions	
5.3.1-5.3.2 Making Dental Impressions 5.3.3 Using Dental Impressions to Identify Suspects	Healthy Living #28: Is There a Health Professional in the House?

<b>Section and Activity</b>	<b>Ranger Program Connections</b>
5.4 Hairs and Fibres 5.5 Unknown Powders and Liquids 5.6 Footprints	No specific program connection
<b>5.7 DNA and Forensic Identification</b>	
5.7.1 DNA Profiling and Criminal Cases 5.7.2 How Alike Are We?	No specific program connection
5.7.3 DNA Extraction 5.7.4 Bar-Code DNA	Healthy Living #29: Health Sciences
<b>6 Crime Scene Investigation</b>	Leadership and Management #16: Leadership and Knowledge  Also, please see program connections for the individual forensic science activities you include in this investigation.
<b>7 Guest Speakers and Field Trips</b>	Community Connections #21: Take Back the Night Global Awareness #10: Women and the Law Healthy Living #13: Healthy Relationships Healthy Living #29: Health Sciences Your Future #12: Know Your Rights Your Future #26: Self-defense Your Future #27: Safety First Your Future #30: Techno Jobs
<b>8 Forensic Science in Real Life</b>	
Program connections that apply to all cases in this section	Global Awareness #3: The World on Your TV Global Awareness #9: That's Illegal? Global Awareness #10: Women and the Law Explore Your Creativity #9: Design 101
8.1 Reality TV?	Explore Your Creativity #4: Hollywood North Explore Your Creativity #7: Documenting Reality
8.2 The Love Bug	Community Connections #29: Online World
8.3 The Hitler Diaries	Your Future #12: Know Your Rights Explore Your Creativity #7: Documenting Reality Explore Your Creativity #14: Picture Perfect
8.4 A 5000-Year-Old Murder	Healthy Living #28: Is There a Health Professional in the House?
8.5 A Strange Union of Fake-ness	Your Future #12: Know Your Rights Explore Your Creativity #7: Documenting Reality Explore Your Creativity #14: Picture Perfect

<b>Section and Activity</b>	<b>Ranger Program Connections</b>
8.6 The Kidnapping of Charles Lindbergh Jr.	Your Future #26: Self-defense Your Future #27: Safety First Community Connections #10: Be Prepared
8.7 Wolves Vs Elk Hunters	Healthy Living #29: Health Sciences Community Connections #26: Community Challenges Global Awareness #25: Conflict and Non-Violence
8.8 Was Napoleon Poisoned?	Healthy Living #29: Health Sciences

## 10 Resources and Links

This section provides a selection of books and websites that can help you talk to your girls about forensic science and related subjects. Please note that these are only suggestions; a trip to your local bookstore or library or an Internet search, will turn up many more resources.

**A note about Internet resources:** The websites listed in this section are intended to help you find resources that are available on the Internet. It is not an exhaustive list; there are literally thousands of websites with information on forensic science and related subjects. These are a few of the sites that we found helpful while we were developing this challenge.

The Internet links listed here were accurate and live at the time this challenge was published (September 2008), but as with all things on the Internet, they may change at any time. If you are having trouble finding a link below, try entering the main words in the site name into a search engine (such as Google) to see if you can find the site or a similar one.

Please note: The Program Committee has visited each of these sites, but has not necessarily tested out all the materials from each site. Nor have we tried to purchase items from those sites that offer things for sale. Please exercise your own judgment before buying online or downloading materials from an unfamiliar website.

### 10.1 Kids and Crime

#### Books

Leave Out Violence (L.O.V.E), *The Courage to Change: A Teen Survival Guide*, Second Story Press, 2001. A teen-to-teen guide by youth; focuses on how to deal with tough issues like isolation, bullying, abuse, family and school pressure, self esteem, loneliness, gangs and relationships.

#### Websites

**SafeCanada.ca:** Resources for kids, parents and teachers on everything from air pollution to street gangs. Includes information on talking to kids and helping kids understand bullying, domestic violence and traumatic events. [www.safecanada.ca](http://www.safecanada.ca)

**Leave Out Violence (L.O.V.E.):** Canadian not-for-profit youth violence prevention organization. Workshops and publications to help youth who have lived with violence end violence in their lives and then become community leaders of violence prevention. [www.leaveoutviolence.com](http://www.leaveoutviolence.com)

**Talking With Kids:** Online resources and help for talking to kids about violence, drugs and other big issues. [www.talkingwithkids.org](http://www.talkingwithkids.org)

## 10.2 Detective Story Series

Check your local bookstore or library for these and other great detective stories for kids:

- *Cam Jansen* by David A. Adler
- *The Hardy Boys* by Franklin W. Dixon
- *Nancy Drew* by Carolyn G. Keene
- *Encyclopedia Brown* by Donald J. Sobol
- *Harriet the Spy* by Louise Fitzhugh
- *Sammy Keyes* by Wendelin Van Draanen
- *Nate the Great* by Marjorie Weinman Sharmat
- *Sherlock Holmes* by Sir Arthur Conan Doyle

## 10.3 Murder Mysteries and Other Mystery Games

### Books:

Nilsen, Anna, *Art Fraud Detective: Spot the Difference, Solve the Crime*, Kingfisher, 2000. Some of the Museum of Art's priceless masterpieces have been stolen and replaced by cunning forgeries! Hone your detective skills and find the tell-tale clues that will help the police track down the master forgers and bring back the missing masterpieces. Combines a mystery story, spot-the-difference puzzles and a fantastic introduction to some of the world's greatest art. Includes historical information on each painting, tips on the techniques of the Old Masters and a glossary of art terms.

### Websites:

**SimpliFun Children's Birthday Parties:** Mystery party games for kids.

[www.mysterypartygames.com](http://www.mysterypartygames.com)

**Kids Mysteries:** Murder-free mystery games. [www.kids-mysteries.com](http://www.kids-mysteries.com)

**Mysteries and More:** Downloadable games and boxed sets. Includes games for kids, teens and adults, with a rating system to help you decide which games are appropriate. [www.murdermysterygames.com](http://www.murdermysterygames.com)

**Mystery Net:** Kids' mystery stories, including quick-solve mysteries and other kid-appropriate activities. <http://kids.mysterynet.com>

## 10.4 Forensic Science

For interesting reading about the early development of forensic science, check your local library or bookstore or search the Internet for information about Edmund Locard, recognized world-wide as the "father of forensic science."

### Books:

Bowers, Vivien, *Crime Science: How Investigators Use Science to Track Down the Bad Guys*, Maple Tree Press, 1997. Detailed, illustrated case files explaining how police solve crimes and catch criminals, from the collection and methodical matching of evidence to high-tech computer crime solving.

Dorling Kindersley, ***Batman's Guide To Crime And Detection***, Dorling Kindersley Ltd., 2003. The Dark Knight of Gotham, the world's greatest detective, takes readers behind the scenes in the world of law enforcement, showing how the world's police catch the bad guys.

Jackson, Donna M., ***The Bone Detectives: How Forensic Anthropologists Solve Crimes and Uncover Mysteries***, Little, Brown, & Company, 1996. Explores the world of forensic anthropology and its applications in solving crimes.

Jackson, Donna M., ***The Wildlife Detectives: How Forensic Scientists Fight Crimes Against Nature***, Houghton Mifflin Company, 2002. Slaughtering elephants for their ivory; shooting bears for their gall bladders; capturing sea turtles for soup. In a laboratory in Ashland, Oregon, scientists analyze clues to link suspects to poaching crimes.

Reichs, Kathy. Many novels, intended for mature readers, based on her work as a forensic scientist. She is a Canadian author and the inspiration for the TV series *Bones*.

Saferstein, R., ***Criminalistics: An Introduction To Forensic Science***, Prentice Hall, 2001. Overview reference on forensic science, often used as a textbook.

Weise, Jim, ***Detective Science: 40 Crime-Solving, Case-Breaking, Crook-Catching Activities for Kids***, John Wiley & Sons, 1996. Search for evidence, gather clues and discover how science can help solve a mystery. These easy, fun-filled activities give a firsthand look at how detectives and forensic scientists use science to solve real-life crimes.

## **Websites:**

**Canadian Society of Forensic Science:** Publishes a very informative booklet ("All You Ever Wanted to Know About Forensic Science in Canada but Didn't Know Who to Ask!") that contains a lot of information on education and careers in various areas of forensic science. It can be downloaded free of charge from the website (1.9MB in pdf format). The website also provides a variety of links to other forensic science organizations.  
[www.csfs.ca](http://www.csfs.ca)

**Centre of Forensic Science:** Website of a branch of the Ontario Ministry of Community Safety and Correctional Services. Has a good "Related Links" section that provides lots of websites to explore for more information on forensics, law enforcement agencies, and careers in forensic science. [www.mcscs.jus.gov.on.ca](http://www.mcscs.jus.gov.on.ca); scroll down the list on the left side to find the link to the Centre of Forensic Science.

**ThinkQuest Forensic Science:** Website dedicated to educating the public about forensic science. Glossaries, activities, background information and more.  
[http://library.thinkquest.org/04oct/00206/lo\\_index.htm](http://library.thinkquest.org/04oct/00206/lo_index.htm)

**HowStuffWorks How Crime Scene Investigation Works:** Good background information on crime scene investigation, including interviews with real-life investigators. Also has links to a variety of other HowStuffWorks and external articles.  
<http://www.howstuffworks.com/csi.htm>

**The Thin Blue Line:** "Unofficial" police website for the state of New South Wales, Australia. Huge section on fingerprinting ("dactyloscopy") and background information on forensic science. [www.policensw.com](http://www.policensw.com)

**The Why Files:** Good background information on a variety of topics in forensic science (and other areas). <http://whyfiles.org/014forensic/>

**Forensic Document Examination Services, Inc.:** Website of a Canadian company specializing in forensic document analysis. Information on handwriting samples, document forging, etc. [www.fdeservices.com](http://www.fdeservices.com)

**Drug Analysis Service:** Interesting website describing the work of Health Canada's Drug Analysis Service to identify suspected illegal substances seized by police or customs officials.

[www.hc-sc.gc.ca/dhp-mps/substancontrol/analys-drugs-droques/index-eng.php](http://www.hc-sc.gc.ca/dhp-mps/substancontrol/analys-drugs-droques/index-eng.php)

**The Human Genome Project:** Background information on DNA and DNA analysis.

[www.ornl.gov/sci/techresources/Human\\_Genome/elsi/forensics.shtml](http://www.ornl.gov/sci/techresources/Human_Genome/elsi/forensics.shtml)

**Genetic Science Learning Centre at the University of Utah:** DNA extraction experiments; also has instructions for building an electrophoresis chamber (a device used by forensic analysts for separating DNA fragments) and for simulating the electrophoresis technique with food colouring. The procedures are complex but would be a cool project for Pathfinders or Rangers. <http://learn.genetics.utah.edu/units/activities/>

## 10.5 True Crime

### Books:

Innes, Brian, *Bodies of Evidence*, Readers Digest, 2000. Discusses over 100 true crime cases and the scientific techniques that helped investigators solve them.

Marvis, B., *Cyber Crimes*, Chelsea House Publications, 1999. Discusses high-tech crimes committed by hackers, crackers and phone phreaks using computers, including fraud, embezzlement and espionage, as well as the best ways to minimize the occurrence of such crimes.

MacDonald, Beverley, *It's True! Crime Doesn't Pay*, Annick Press, 2006. Full of crazy-but-true stuff. From torch-bearing vigilantes to hi-tech crime scene investigators, journey from the time when a crook had to be caught red-handed to be proven guilty to the present and how we use science to solve crimes.

Olshaker, Mark and Douglas, John, many titles. World-renowned and fascinating forensic psychologists.

Owen, David, *Hidden Evidence: Forty True Crimes and How Forensic Science Helped to Solve Them*, Firefly Books, 2002. Explores the forensic investigations of 40 crimes, including the Oklahoma bombing, the Lindbergh kidnapping, Pan Am flight 103, The Kennedy Investigation, Ted Bundy and the World Trade Center bombing.

### Websites:

**Crime Library: Criminal Minds and Methods:** Information and articles on real-life crimes, criminology, forensic science. Includes current and historical crimes, everything from Jesse James to O.J. Simpson. Caution: this website is quite graphic. It is best suited for background information for adults, rather than direct sharing with girls.

[www.crimelibrary.com](http://www.crimelibrary.com)

**Ötzi the Iceman:** Transcript of a documentary on BBC Science and Nature TV.

[www.bbc.co.uk/science/horizon/2001/icemantrans.shtml](http://www.bbc.co.uk/science/horizon/2001/icemantrans.shtml)

## 10.6 Organizations

**Law Court Education Society of BC:** Downloadable pamphlets about the BC court system and court proceedings. Some mock trial materials available for purchase (suitable for older girls only); may be able to provide free materials on request. Has offices in a number of regions of the province; check the website or your local phone book for contact information. [www.lces.ca](http://www.lces.ca)

**Royal Canadian Mounted Police:** Check your phone book for contact information for your local detachment or visit the RCMP website. [www.rcmp.ca](http://www.rcmp.ca)

**Vancouver Police Museum:** Forensic science programs for kids, walking tours of Vancouver, summer youth camp programs. [www.vancouverpolicemuseum.ca](http://www.vancouverpolicemuseum.ca).  
240 E. Cordova Street, Vancouver, BC V6A 1L3

# 11 CSI Challenge Crest Order Form

Please give this form to your area program adviser, via your district program adviser if you have one. She will get crests for you.

Contact Guider: \_\_\_\_\_

Mailing Address: \_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

Unit Name: \_\_\_\_\_

Branch:    Sparks       Brownies    Guides       Pathfinders    Rangers    Adults

Number of crests required: \_\_\_\_\_

What was your favourite part of the challenge?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_