

# **Who Dun It?**

**Leader's Resource Guide  
and  
Activity Instructions**

# STANet Science Packs

Thank you for choosing a STANet Science Pack. The Science and Technology Awareness Network (STANet) is a network of organizations, government departments, educators, and individuals working together to promote science and technology awareness and programs in Nova Scotia. Our goal in producing the Science Packs is to present information about science and technology in real, relevant and fun situations. This resource will allow participants to immerse themselves in the fields of real scientists, and experience and develop scientific processes.

We hope these kits will be a valuable resource for many people. We need your help to ensure this. Please clean and replace all pack contents into the appropriate containers prior to returning them to STANet. We also encourage and welcome your feedback on the packs. Please fill in the comment form included when you return the kit to STANet.

Return kit to:

STANet  
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If you have any questions or comments please call the STANet Coordinator at :  
1-800-565-7487 or (902)494-2698.

# Who Dun It??

## - A Murder Mystery Adventure into the World of Investigative Science

“**Who Dun It?**” is a program developed with the cooperation of the RCMP Forensic Laboratory and the Chief Medical Examiner’s Office in Halifax, to encourage and develop the skills of investigation. The program is suitable for grades 5+ and families.

The “**Pack**” contains:

- Introduction
- Activity Instructions
  - ⇒ Scenario 1 , 2, 3
- Materials required to complete the adventure
- Investigator’s Journal
- Supplemental activities and materials

The **Introduction** provides some background information on forensic sciences. The material given realistically outlines the process police and forensic scientists follow when solving a crime.

**Activity Instructions** are divided among three scenarios, each progressively more challenging. You may chose your scenario based on the grade level of participants and how challenging you would like the investigation to be.

- ⇒ *Scenario 1* is the simplest and most clear cut with only one possible culprit.
- ⇒ *Scenario 2* leads to two possible culprits and the resolution of the crime using DNA evidence.
- ⇒ *Scenario 3* presents inconclusive evidence to solve the crime, a situation often encountered in reality.

**Materials** for each activity are packed in separate labeled containers. Please take care to replace the contents back in their proper containers when the activity is complete.

The **Investigator’s Journal** is a guide and notebook for participants as they work through their investigations. For teachers it provides something to evaluate at the conclusion of the kit.

**Supplemental Activities** provide extensions, resources and additional activities for your class or group of participants. You may chose to use them to form an entire unit for your class or just to supplement the skills developed during the course of the adventure.

The activities were intended to be done in a series leading to the solution of a crime. Teams of participants gather information after each activity to solve the crime. However, activities can be done separately without involving the murder mystery.

**Please remember to replace all materials back into the kit as they were when you received it.**

# **Introduction**

An investigation into a crime involves many different people and departments. The police work closely with the medical examiner's office to determine cause of death and forensic specialists carefully analyse the evidence. An investigation is very much like fitting together pieces of a puzzle.

## **Parts of an Investigation**

There are basically 2 parts to any investigation:

- I. Collecting Evidence
- II. Analyzing Evidence

### *Collecting Evidence*

#### Fingerprints

Fingerprints can be left anywhere, doorknobs, window seals, tabletops, etc. The process is fairly simple. One method is the use of graphite shavings. The person gathering the fingerprints should always wear gloves to prevent contamination of the evidence. Even though the person has gloves on, he/she should not touch the area where the fingerprints are. The investigator places a brush in the graphite shavings. Next, he/she lightly brushes the area, which is called dusting. After dusting for the fingerprints, the investigator locates the print and removes it with clear tape. After removing the fingerprint, the tape is placed on a white card. This method, modified slightly, will be used in this package.

Another method is to use lead shavings. This method requires the use of a magnet. The investigator places lead shavings on the area containing the prints. A magnet is then used to remove the lead shavings. These shavings are then applied to tape in a similar fashion as with the graphite shavings.

#### Blood

Blood is a key indicator of foul play. It often provides the deciding factor in the solution of a crime by providing a sample of DNA left behind by a suspect.

#### Trace Evidence

Trace evidence includes things like clothing fibers, glass and paint which need to be collected and sent to a lab. Investigators either wrap tape around their hands and run it over the area, or they vacuum the area. They may even run tape over clothing found at the scene. They then put the tape into a bag, seal it, and label it, or take the bag out of the vacuum and label it.

### Tool Marks and Shoe Prints

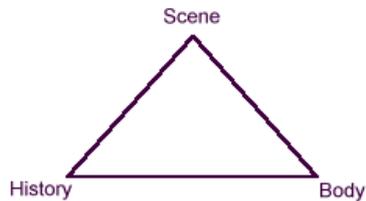
A tool can be anything from a hammer to a boot, or a gun to a vase. Marks made by tools at the scene of a crime can help investigators piece together what happened at the crime scene. Casts of tool marks can be made using a silicone rubber and a catalyst. A mixture is applied to the tool mark and an impression made. After the rubber has hardened it is removed and compared to the suspected tool. A groove on a tool will match a ridge in the cast and vice versa. Shoe prints can be collected in a similar fashion. In this package, shoe prints will be analyzed using a modified method.

### *Analyzing Evidence*

Once the evidence has been collected it is sent to a forensic laboratory for analysis. Sections of the lab carefully examine the evidence to discover clues and relationships between the victim and the suspect, the victim and the crime scene or the suspect and the crime scene.

### **Principles of Investigation**

There are 3 main areas, inherently connected, which investigators examine.



Scene: The location of death, was the body moved, how is the body positioned in its surroundings, signs of violence, examine evidence.

History: the medical, social and psychological history of the victim.

Body: position, age, signs of violence (bruises, blood, clothing)

### **Questions**

Investigators are often guided in their investigations by the following familiar questions:

- Who? - identity of the victim and suspects
- When? - time of death
- Where? - place of death

- Why? - motive
- How? - cause of death

## **Roles in an investigation**

### Role of the Police:

The police are usually the first people to arrive at the scene of a crime. They are the prime investigators. They gather all the evidence at the scene (bag and record) and maintain the integrity of the scene, making sure it not contaminated by police or anyone else who may enter the location of the crime. Police act as intermediaries between the medical examiner's office and the forensic lab to ensure all those involved receive the information they require.

### Role of the Medical Examiner's Office:

1. Determine if the death is natural or unnatural
2. Look for evidence from medication, food ingested, needles, etc.
3. Examine the body
  - A. Attitude or position of the body - has it been moved?, is it in a natural position?, position of body relative to surrounding objects
  - B. Age - women under 70 and men under 60 are investigated
  - C. Signs of violence - blood, ripped clothing, etc.
5. Interview family, ambulance attendants, family doctor, etc.

### Role of the Forensic Laboratory:

The forensic lab analyses evidence gathered by police and the medical examiner's office.

Evidence is analysed in a number of different sections within the forensic lab:

1. Alcohol
  - ⇒ analyse blood from impaired driving cases, deaths involving alcohol, bootlegging, etc.
2. Toxicology
  - ⇒ analyse poisonings, prescription drugs, over-the-counter drugs, street drugs, sudden deaths
3. Chemistry
  - ⇒ analyse trace evidence: glass analysis in break and enter cases, paint analysis in car accidents and stolen vehicles, fiber analysis
4. Firearms
  - ⇒ analyse tool markings - tire slashes, tree cuts, bullet matches

- ⇒ physical matching - trace a burnt match back to the original match book
  - ⇒ weapons analysis
5. Documents
- ⇒ hand writing analysis - forged cheques, threats, suicide notes, etc.
  - ⇒ ink analysis
6. Biology
- ⇒ DNA analysis - from blood, semen, hair and saliva. DNA from the epithelial cells surrounding a hair shaft, in white blood cells or in other body fluids are used to determine identity of those present at the crime scene.

The forensic lab must determine an association between at one of the following:

- the victim and the accused
- the victim and the scene
- the accused and the scene

## Activity Instructions - Scenario 1

**This scenario is the simplest. It will reveal evidence pointing to only one suspect.**

Some preparation will be necessary before the adventure begins for participants.

### **What to do:**

1. In the middle of the room do a masking tape outline of a person; the victim. Beside the outline of the victim place the “murder weapon” (club), a scrap of paper with a note written on it in ink, a piece of torn material, a foot print (made by the culprit).
2. A “line-up” of suspects must be chosen. It is best if these are chosen from outside of the group who will be participating in the investigation. Four or five is a good number of people. If you are working in a school, perhaps the principal, the vice principal, secretary, another teacher, guidance teacher, etc. could participate as suspects.
3. Take the fingerprints from **ALL** the suspects **RIGHT** hands and place them on separate sheets of paper following instruction from Activity 1. Be sure to label whose prints are whose and keep these in a safe place. (**folder provided to keep evidence from the crime scene**)
4. You must choose one person from the line-up to be the culprit. This role involves a little more than the others in the line-up as you need a set of clues specifically from this person.
5. Preparing the “culprit” specific clues:
  - Take **6** impressions of the “murderer’s” shoe print following the instructions in Activity 2. One print is for the crime scene, the others are for use by the groups for analysis. **It is very important that the culprit wear these same shoes on the day the participants pick the “murderer” from the line-up.** You may wish to ask all people in the line up to wear similar shoes that day (ie sneakers) to make the choice more difficult.
  - The “murderer’s” fingerprints must be made on the “murder weapon”. To facilitate a good take of the print, have the “murderer” use some hand cream on his/her fingertips and then place them on the weapon. Use only the forefinger and the thumb to touch the weapon. **It is very important that the weapon be moved carefully so the prints are not rubbed off or replaced with another person’s prints. Put the weapon in the plastic bag provided after the prints are in place.**

- A special “murderer’s pen” and “murderer’s clothing piece” (contained in this kit) must be “planted” on the culprit the day the participants pick him/her from the line-up. This is important because the note found next to the victim’s outline was written with this pen and the piece of torn material matches the one found on the culprit.

## 6. Preparing your group of participants

- **-Grouping:** Participants should be in groups of 5 or 6.
- -Each participant will receive a detective card (see following page) containing the name of a famous detective, and a cooperative role written on the card. Together the entire groups’ detectives will solve the mystery at hand and use the knowledge gained through the activities to determine the culprit.
- -Each participant will receive an Investigator’s Journal which will guide them through the activities and to a “solution” to the crime.
- -Participants are now ready to be introduced to the crime scene and read the preliminary report (page 1 - Investigator’s Journal). It is most effective if you read this aloud while pointing to evidence at the scene of the crime.

⇒ You’re now ready to begin the investigation!!

## **Detective Cards:**

These cards list information on a detective along with a cooperative role for each member of the group. Each participant will be assigned a cooperative role with these cards.

### **Matlock**

A modern-day lawyer and detective, this man searches – inside and out, upside down, backward and forward – to get the answers he needs to clear his clients. **Starter- first person to put materials to use**

### **Sherlock Holmes**

Holmes has more than 50 years of detective experience to his name. He's solves mysteries and crimes from Reno to Rome. **Recorder- records data**

### **Batman**

Yes, he is a detective, and his super powers help him to do an outstanding job. **Getter- Gets and returns Materials**

### **Nancy Drew**

She's an experienced young detective and mystery solver who is able to solve any case that comes her way. **Checker- checks work**

### **Dana Scully (X-Files)**

This FBI Agent and forensic scientist is very suspicious of unusual findings and uses this to get to the bottom of a situation. **Reader- reads instructions, summarizes findings to the rest of the group**

### **Jessica Fletcher (Murder She Wrote)**

This murder mystery writer uses her skills to investigate and solve real murders. **Encourager- provides positive support**

## **Activity 1 : “FOUL PLAY FINGERS” (FINGERPRINTING)**

Fingerprinting is the main method for identifying a person. Fingerprints are the impressions left by the ridges on the tips of the fingers due to sweat excreted by glands and oils picked up by the hands. The patterns on fingers remain unchanged for life, and no two fingerprints are the same. Each person's fingerprints are their own personal signature.

Fingerprints can be classified according to the types of patterns and the number of ridges. There are 3 main types of fingerprints: arches (5% of population), loops (60-65%), whorls (30-35%).

**Time: 40 minutes**

### **Materials:**

talcum powder (leader)  
soft paint brush (leader)  
finger print chart (1 / group)  
roll of transparent tape (1 / group)  
white paper  
hand lens (1 / person)  
pencils

**WARNING:** Do not let participants put their graphite covered fingers near their mouth or eyes!!!

### **What to do:**

1. Pass out paper to each person along with one extra piece per group.
2. One person in each group will rub a pencil on a piece of paper to make a large heavy smudge of graphite (lead).
3. Each participant will rub a finger tip/pad (the part of the finger from the first knuckle to the tip) over the smudge until it is silver-coloured. Participants should use their dominant hand.
4. Each participant will stick a short length of tape (long enough to cover the whole top part of the finger) directly on to the finger tip and will press down.
5. Each participant will peel the tape off of the finger tip and place it on their own Finger print Record. The graphite will show the print perfectly through the tape.
6. Repeat steps 2-4 (3-6 in Investigator's Journal) for each finger. Each person will have their own page of prints. Have them print their names on the page.

(At this point participants usually start to suspect that someone in the room has committed the crime)

7. Have the group examine details of the fingerprints with a magnifying glass and compare prints to those on the fingerprint chart (see following chart).
8. Each participant should write a description of their fingerprint using vocabulary from the fingerprint chart (loop, whorl, arch) on their individual fingerprint paper.
9. Have participants examine and compare each others fingerprints.
10. A discussion about fingerprints and how each person's is different from the next may follow.

### **At the Scene of the Crime**

- Ask the whole group where finger prints might be found at the crime scene
- Carefully pick up the murder weapon and take it out of the bag. Sprinkle it carefully with talcum powder and then brush it with a soft paint brush. Explain to the group that you are attempting to develop a latent fingerprint of the culprit. The powder will cling to the natural oil on the prints, outlining them clearly in white. Return the weapon to the bag. (**Do Not disturb the finger prints**)
- Have one member of each group examine the print and return to their groups. (Many participants will wish to compare prints to the print on the weapon at this time. If time permits this can be done. At this time you can let the group know that no one in the room is a suspect for the crime and comparing their fingerprints is unnecessary or you may let them keep wondering if ,indeed, someone in the room has committed the murder.)
- The member will report their observations of the print to the group so that each participant can record observations of the prints found at the crime scene in the Crime Scene Observations section of the Investigator's Journal. Let them know that it is very important to have detailed records of what they see and where the prints were found as well as what they look like.
- Save the evidence.

# Fingerprint Chart

Compare your prints to the following diagrams:

## **Activity 2 : “Forensic Footprints”**

When police and forensic personnel examine the scene of a crime they look closely at any marks possibly left behind by a suspect. Impression marks can be left by tires, shoes, teeth, ... Impression marks can tell a forensic scientist how tall a person is, how they walk and sometimes even what their suspect may look like.

You can easily make a copy of your own footprint and examine what makes your shoe different from the same shoe on another person.

**Time: 20 minutes**

### **Materials:**

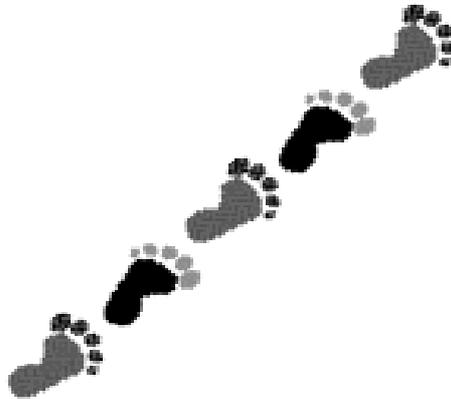
a can of spray oil, such as Pam (1 / group)  
a sheet of plain white paper (1/ person)  
several sheets of newspaper

### **What to do:**

1. Distribute materials to each group.
2. Have one member from each group **lightly** spray the bottom of their shoe with oil and then step on the blank sheet of white paper.
3. Wipe the shoe with newspaper.
4. Let the oil dry a bit and then examine the impression made by the footprint.
5. Discuss what characteristics might be critical to forensic personnel. What makes this shoe print unique? What marks on the print show everyday wear? Can they tell how the person walks? How could you tell the weight and height of a person from the print?

## **At the Scene of the Crime**

- Pass out copies of the culprit's footprint to each group
- Groups will examine the footprint found at the crime scene.
- Participants will sketch the print in their Investigator's Journals in the Crime Scene Observations section and pick out any special features of the print.
- Discuss what the print might tell you about the suspect.
- Save the evidence



### **Activity 3 : “The Marker of a Crime” (Chromatography - Ink Analysis)**

Not often, but sometimes, a suspect will drop something which will provide another clue for forensic scientists. In this case, a note written on with ink. Ink analysis or chromatography is used to discover the brand and type of ink used to type or write on a document.

Black ink is actually a mixture of many different colours or dyes of ink. Different combinations of dyes are found in different brands of ink. Paper chromatography separates these dyes so a forensic scientist can see the amount and saturation of colours in the ink and determine the brand of ink used. In real investigations ink can be carefully removed from evidence and placed on filter paper. Chromatography results are then compared to inks of several different brands and traced back to possible suspects.

**Time: 30 minutes**

**Materials:**

6 different brands of black felt markers **per group**

7 strips chromatography paper **per person**

2 plastic beakers half filled with water **per group**

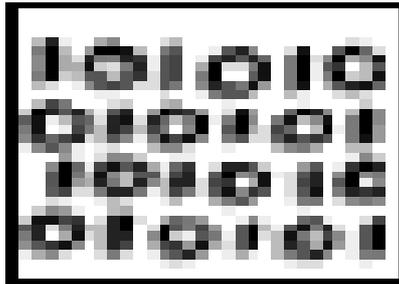
tape

**What to do:**

1. Distribute materials to groups
2. Using one of the felt markers have a member of each group draw a line approximately 2cm from the bottom of one strip of chromatography paper.
3. Dip the end (and only the end! If the ink touches the water you must start over) of the chromatography paper into the water and wait about 10 minutes. The colours will begin to divide as the water creeps up the paper.
4. Participants will attach the results of each marker in the Chromatography record and write the brand next to it. They will have 6 samples.
5. Have groups compare results with other groups and see if they can determine from the chromatography alone which pens are the same brand.

## **At the Scene of the Crime**

- You will perform paper chromatography on the note found at the scene of the crime which is written on chromatography paper
- Compare the results with those done in the groups. Is it like any of the pens used by the participants?
- Participants will record their observations in the Crime Scene Observation section of the Investigator's Journal.
- Save the evidence.



## **Activity 4 : “Thread Bearing Evidence” (Fiber Analysis)**

Sometimes investigators discover trace evidence at the scene of the crime. Glass, paint and materials fibers are examples of the types of evidence valuable to an investigation.

Fibers are collected and analysed to determine the type of fabric. This may allow a trace to the clothing the suspect was wearing when the crime occurred.

**Time: 30 minutes**

### **Materials:**

5 pieces of same colour fabric  
hand lens (1 / person)

### **What to do:**

1. Distribute materials to groups.
2. Each participant will pull a few threads/fibers from one piece of fabric.
3. Each participant will examine the fibers using the hand lens, touch and unaided vision. Look for texture, thickness of fibers, twist of fibers, transparency of fibers.
4. Each participant will sketch the fiber and write observations.
5. Repeat steps 2 -4 for two more fabrics so that 3 in total will be analysed.
6. Participants will compare the fiber analysis for each fabric.

### **At the Scene of the Crime**

- Provide each participant with a piece of fabric taken from the fabric found at the crime scene

Participants will analyse this fabric, as in above activity, recording their observations in the Crime Scene Observations section of the Investigator’s Journal.

## **Example Diagrams for Thread Bearing Evidence**

## **Beyond a Shadow of a Doubt: Choosing the culprit from a line up of suspects**

This is the point where all the evidence collected and analyzed from the crime scene comes into play.

**IMPORTANT:** The 4 or 5 suspects which you have chosen from outside the group must be available to the group for about 40 minutes. This allows evidence to be compared to the suspects. Match the pen and the material piece on the chosen culprit. (Other suspects can have pens and material swatches too, but make sure they are totally different from the one the culprit has.)

**Make sure the culprit is wearing the same shoes as the one's the original print was taken from.**

### **Materials:**

Crime Scene Observations section from Investigator's Journal  
Line-up of suspects (4/5 people you have chosen)  
Finger prints of suspects  
Culprit's pen  
Culprit's fabric  
Filter paper  
Plastic glass with water  
Hand lens (1 / person)  
Evidence saved from crime scene folder  
Warrant for arrest

### **What to do:**

1. Set up a table(s) exhibiting evidence taken from the 4/5 suspects. This would include the fingerprints for all suspects.
2. Plant the material and pen on the culprit you have chosen.
3. Have the evidence saved from the crime scene available.
4. The 4/5 suspects should be brought in and positioned beside the evidence belonging to them. If the suspects are not known to the group name tags should be provided.
5. You may ask the group how you should proceed. It may be as follows:

6. The group can begin to analyse the evidence gathered at the crime scene by comparing it to the evidence presented for each suspect.
  - A. A member from each group (ie. MATLOCKS) will examine the fingerprints of **all** suspects and compare to the evidence they recorded in the Crime Scene Observations. Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal. (Place a check under the suspect whose evidence matches that found at the crime scene)
  - B. Another group member (ie. NANCY DREWS) will examine the shoes of **all** the suspects and compare to the evidence they recorded in the Crime Scene Observations. Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal.
  - C. Suspects are asked if they are carrying any pens. Evidence is produced in the culprit's pen and if anyone else has a pen these are produced at this time. Each pen can be analysed using the same procedure in Activity 3. To save time the leader/teacher do this test and have a member of each group come up and examine the results (SHERLOCK HOLMESs). Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal.
  - D. The piece of material is discovered. Each group should be provided with a few strands of the material to examine using the method in Activity 4. Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal.
7. Participants will analyse the results recorded in the Suspect Evidence Table and write a warrant for the arrest of one of the suspects. **The group must agree on a single person to arrest.** A member from each group (DANA SCULLYs) will stand and read their warrant. If the whole group agrees on the culprit the leader/teacher can fill in the warrant for arrest and give it to the suspect in question. If there is some disagreement discussion must follow and the evidence saved from the crime scene reviewed until agreement is reached and the culprit is issued a warrant.

**Example of results recorded in Suspect Evidence Table for Scenario 1:**

SUSPECT

	A	B	C	D	E
Fingerprint		✓			
Footprint		✓			
Pen		✓			
Fiber		✓			

## Activity Instructions - Scenario 2

**This scenario reveals evidence pointing to at least two possible culprits and can be solved using DNA analysis. The directions provide information for 2 possible suspects. You can increase the challenge by providing additional suspect evidence at the crime scene.**

Some preparation will be necessary before the adventure begins for participants.

### **What to do:**

1. In the middle of the room do a masking tape outline of a person; the victim. Beside the outline of the victim place the “murder weapon” (club???), a scrap of paper with a note written on it in ink, a piece of torn material, a foot print (made by the culprit).
2. A “line-up” of suspects must be chosen. It is best if these are chosen from outside of the group who will be participating in the investigation. Four or five is a good number of people. If you are working in a school, perhaps the principal, the vice principal, secretary, another teacher, guidance teacher, etc. could participate as suspects.
3. Take the fingerprints from **ALL** the suspects **RIGHT** hands and place them on separate sheets of paper following instruction from Activity 1. Be sure to label whose prints are whose and keep these in a safe place. (**folder provided to keep evidence from the crime scene**)
4. You must choose one person from the line-up to be the culprit and another suspect to supply evidence at the crime scene.
5. Preparing the evidence at the crime scene:
  - Take **6** impressions of the chosen suspect’s shoe print following the instructions in Activity 2. Take **6** impression of the chosen culprit’s shoe print as well. One of each print is for the crime scene, the others are for use by the groups for analysis. **It is very important that the suspect and the culprit wear these same shoes on the day the participants pick the “murderer” from the line-up.** You may wish to ask all people in the line up to wear similar shoes that day (ie sneakers) to make the choice more difficult.
  - The chosen suspect’s and culprit’s fingerprints must be made on the “murder weapon”. To facilitate a good take of the print, have each of them use some hand cream on their fingertips and then place them on the weapon. Use only the forefinger and the thumb to touch the weapon. **It is very important that the weapon be moved carefully so the prints are**

**not rubbed off or replaced with another person's prints. Put the weapon in the plastic bag provided after the prints are in place.**

- A special "murderer's pen" and "murderer's clothing piece" (contained in this kit) must be "planted" on the culprit and the chosen suspect the day the participants view the line-up. This is important because the note found next to the victim's outline was written with the pen and the piece of torn material matches the one found on the suspect and culprit.

#### 6. Preparing your group of participants

- **-Grouping:** Participants should be in groups of 5 or 6.
- -Each participant will receive a detective card (see following page) containing the name of a famous detective, and a cooperative role written on the card. Together the entire groups' detectives will solve the mystery at hand and use the knowledge gained through the activities to determine the culprit.
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Holmes has more than 50 years of detective experience to his name. He's solves mysteries and crimes from Reno to Rome. **Recorder- records data**

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Yes, he is a detective, and his super powers help him to do an outstanding job. **Getter- Gets and returns Materials**

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She's an experienced young detective and mystery solver who is able to solve any case that comes her way. **Checker- checks work**

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This FBI Agent and forensic scientist is very suspicious of unusual findings and uses this to get to the bottom of a situation. **Reader- reads instructions, summarizes findings to the rest of the group**

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This murder mystery writer uses her skills to investigate and solve real murders. **Encourager- provides positive support**

## **Activity 1 : “FOUL PLAY FINGERS” (FINGERPRINTING)**

Fingerprinting is the main method for identifying a person. Fingerprints are the impressions left by the ridges on the tips of the fingers due to sweat excreted by glands and oils picked up by the hands. The patterns on fingers remain unchanged for life, and no two fingerprints are the same. Each person's fingerprints are their own personal signature.

Fingerprints can be classified according to the types of patterns and the number of ridges. There are 3 main types of fingerprints: arches (5% of population), loops (60-65%), whorls (30-35%).

**Time: 40 minutes**

### **Materials:**

talcum powder (leader)  
soft paint brush (leader)  
finger print chart (1 / group)  
roll of transparent tape (1 / group)  
white paper  
hand lens (1 / person)  
pencils

### **What to do:**

1. Pass out paper to each person along with one extra piece per group.
2. One person in each group will rub a pencil on a piece of paper to make a large heavy smudge of graphite (lead).
3. Each participant will rub a finger tip over the smudge until it is silver-coloured.
4. Each participant will stick a short length of tape directly on to the finger tip and will press down.
5. Each participant will peel the tape off of the finger tip and place it on their own piece of paper (plain white), and write which finger it was below the print. The graphite will show the print perfectly through the tape.
6. Repeat steps 2-4 for each finger. Each person will have their own page of prints. Have them print their names on the bottom. (At this point participants usually start to suspect that someone in the room has committed the crime)
7. Have the group examine details of the fingerprints with a magnifying glass and compare prints to those on the fingerprint chart (see following chart).

8. Each participant should write a description of their fingerprint using vocabulary from the fingerprint chart (loop, whorl, arch) on their individual fingerprint paper.
9. Have participants examine and compare each others fingerprints.
10. A discussion about fingerprints and how each person's is different from the next may follow.

### **At the Scene of the Crime**

- Ask the whole group where finger prints might be found at the crime scene
- Carefully pick up the murder weapon and take it out of the bag. Sprinkle it carefully with talcum powder and then brush it with a soft paint brush. Explain to the group that you are attempting to develop latent fingerprints of the culprit. The powder will cling to the natural oil on the prints, outlining them clearly in white. Return the weapon to the bag. (**Do Not disturb the finger prints**)
- Have one member of each group examine the prints and return to their groups. (Many participants will wish to compare prints to the print on the weapon at this time. If time permits this can be done. At this time you can let the group know that no one in the room is a suspect for the crime and comparing their fingerprints is unnecessary or you may let them keep wondering if ,indeed, someone in the room has committed the murder.)
- The member will report their observations of the prints to the group so that each participant can record observations of the prints found at the crime scene in the Crime Scene Observations section of the Investigator's Journal. Let them know that it is very important to have detailed records of what they see and where the prints were found as well as what they look like.
- Save the evidence.

# Fingerprint Chart

Compare your prints to the following diagrams:

## **Activity 2 : “Forensic Footprints”**

When police and forensic personnel examine the scene of a crime they look closely at any marks possibly left behind by a suspect. Impression marks can be left by tires, shoes, teeth, ... Impression marks can tell a forensic scientist how tall a person is, how they walk and sometimes even what their suspect may look like.

You can easily make a copy of your own footprint and examine what makes your shoe different from the same shoe on another person.

**Time: 20 minutes**

### **Materials:**

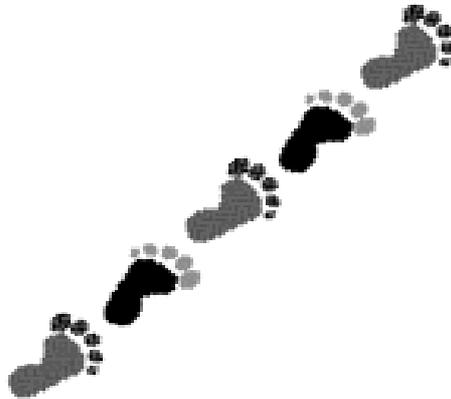
a can of spray oil, such as Pam (1 / group)  
a sheet of plain white paper (1/ person)  
several sheets of newspaper

### **What to do:**

1. Distribute materials to each group.
2. Have one member from each group **lightly** spray the bottom of their shoe with oil and then step on the blank sheet of white paper.
3. Wipe the shoe with newspaper.
4. Let the oil dry a bit and then examine the impression made by the footprint.
5. Discuss what characteristics might be critical to forensic personnel. What makes this shoe print unique? What marks on the print show everyday wear? Can they tell how the person walks? How could you tell the weight and height of a person from the print?
6. If time permits other members of the group can take their prints and examine them.

## **At the Scene of the Crime**

- Pass out copies of the culprit's and chosen suspect's footprints to each group
- Groups will examine the footprint found at the crime scene.
- Participants will sketch the print in their Investigator's Journals in the Crime Scene Observations section and pick out any special features of the print.
- Discuss what the print might tell you about the suspect.
- Save the evidence



### **Activity 3 : “The Marker of a Crime” (Chromatography - Ink Analysis)**

Not often, but sometimes, a suspect will drop something which will provide another clue for forensic scientists. In this case, a note written on with ink. Ink analysis or chromatography is used to discover the brand and type of ink used to type or write on a document.

Black ink is actually a mixture of many different colours or dyes of ink. Different combinations of dyes are found in different brands of ink. Paper chromatography separates these dyes so a forensic scientist can see the amount and saturation of colours in the ink and determine the brand of ink used. In real investigations ink can be carefully removed from evidence and placed on filter paper. Chromatography results are then compared to inks of several different brands and traced back to possible suspects.

**Time: 30 minutes**

**Materials:**

6 different brands of black felt markers **per group**

7 strips chromatography paper **per person**

2 plastic beakers half filled with water **per group**

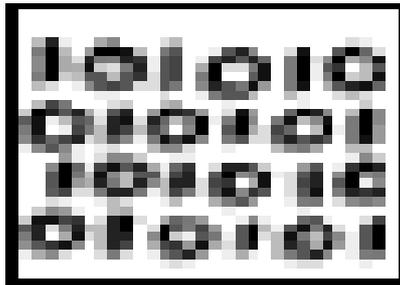
tape

**What to do:**

1. Distribute materials to groups
2. Using one of the felt markers have a member of each group draw a line approximately 2cm from the bottom of one strip of chromatography paper.
3. Dip the end (and only the end! If the ink touches the water you must start over) of the chromatography paper into the water and wait about 10 minutes. The colours will begin to divide as the water creeps up the paper.
4. Participants will attach the results of each marker in the Chromatography record and write the brand next to it. They will have 6 samples.
5. Have groups compare results with other groups and see if they can determine from the chromatography alone which pens are the same brand.

## **At the Scene of the Crime**

- You will perform paper chromatography on the note found at the scene of the crime which is written on chromatography paper
- Compare the results with those done in the groups. Is it like any of the pens used by the participants?
- Participants will record their observations in the Crime Scene Observation section of the Investigator's Journal.
- Save the evidence.



## **Activity 4 : “Thread Bearing Evidence” (Fiber Analysis)**

Sometimes investigators discover trace evidence at the scene of the crime. Glass, paint and materials fibers are examples of the types of evidence valuable to an investigation.

Fibers are collected and analysed to determine the type of fabric. This may allow a trace to the clothing the suspect was wearing when the crime occurred.

**Time: 30 minutes**

### **Materials:**

5 pieces of same colour fabric  
hand lens (1 / person)

### **What to do:**

1. Distribute materials to groups.
2. Each participant will pull a few threads/fibers from one piece of fabric.
3. Each participant will examine the fibers using the hand lens, touch and unaided vision. Look for texture, thickness of fibers, twist of fibers, transparency of fibers.
4. Each participant will sketch the fiber and write observations.
5. Repeat steps 2 -4 for two more fabrics so that 3 in total will be analysed.
6. Participants will compare the fiber analysis for each fabric.

### **At the Scene of the Crime**

- Provide each participant with a piece of fabric taken from the fabric found at the crime scene
- Participants will analyse this fabric, as in above activity, recording their observations in the Crime Scene Observations section of the Investigator’s Journal.

## **Beyond a Shadow of a Doubt: Choosing the culprit from a line up of suspects**

This is the point where all the evidence collected and analyzed from the crime scene comes into play.

**IMPORTANT**: The 4/5 suspects which you have chosen from outside the group must be available to the group for about 40 minutes. This allows evidence to be compared to the suspects. Match the pen and the material piece on the chosen culprit and chosen suspect. (Other suspects can have pens and material swatches too to increase the difficulty, but make sure they are totally different from the one the culprit has.)

**Make sure the culprit and chosen suspect are wearing the same shoes as the one's the original prints were taken from.**

### **Materials:**

Crime Scene Observations section from Investigator's Journal  
Line-up of suspects (4/5 people you have chosen)  
Finger prints of suspects  
Culprit's pen  
Culprit's fabric  
Filter paper  
Plastic glass with water  
Hand lens (1 / person)  
Evidence saved from crime scene folder  
Warrant for arrest

### **What to do:**

1. Set up a table(s) exhibiting evidence taken from the 4/5 suspects. This would include the fingerprints for all suspects, the pen and material matched to the culprit and chosen suspect and pens and materials you may wish to add to increase the challenge.
2. Have the evidence saved from the crime scene available.
3. The 4/5 suspects should be brought in and positioned beside the evidence belonging to them. The suspects should be "lettered" A-E/F. **The culprit must be assigned as "B"**.
4. You may ask the group how you should proceed. It may be as follows:

5. The group can begin to analyse the evidence gathered at the crime scene by comparing it to the evidence presented for each suspect.
  - A. A member from each group (ie. MATLOCKS) will examine the fingerprints of **all** suspects and compare to the evidence they recorded in the Crime Scene Observations. Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal. (Place a check under the suspect whose evidence matches that found at the crime scene)
  - B. Another group member (ie. NANCY DREWS) will examine the shoes of **all** the suspects and compare to the evidence they recorded in the Crime Scene Observations. Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal.
  - C. Suspects are asked if they are carrying any pens. Each pen can be analysed using the same procedure in Activity 3. To save time the leader/teacher can do this test and have a member of each group come up and examine the results (SHERLOCK HOLMESs). Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal.
  - D. The pieces of material are discovered. Each group should be provided with a few strands of the material to examine using the method in Activity 4. Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal.
7. Participants will analyse the results recorded in the Suspect Evidence Table and attempt to write a warrant for the arrest of one of the suspects. **The group must agree on a single person to arrest.** A member from each group (DANA SCULLYs) will stand and read their warrant. If the whole group agrees on the culprit the leader/teacher can fill in the warrant for arrest and give it to the suspect in question. If there is some disagreement discussion must follow and the evidence saved from the crime scene reviewed.
8. It should be evident that there are 2 possible suspects and insufficient evidence to arrest only one. The leader should ask the group what other sort of evidence might be collected from a crime scene. At this point the DNA evidence can be introduced (**Activity 5**).
9. After the DNA analysis participants should rewrite their warrants and agree on whom they should arrest. The teacher/leader can fill in the warrant for arrest and give it to the suspect.

**Example of results recorded in Suspect Evidence Table for Scenario 2:**

SUSPECT

	A	B	C	D	E
Fingerprint		✓		✓	
Footprint		✓		✓	
Pen		✓		✓	
Fiber		✓		✓	
<b>DNA</b>		✓			

## **Activity 5 : “It’s a Match” - DNA Analysis**

### **Background information:**

#### Examples of Ways DNA Profiling(Typing, Fingerprinting) Has Been Used.

Each of the following paragraphs describes a way in which DNA has been used to show how individuals are related to each other, or to show that a person is (or is not) the perpetrator of a crime. DNA typing, DNA profiling, and DNA fingerprinting are all names for the same process, a process which uses DNA to show relatedness or identity of individuals. This process has been used to free innocent suspects, reunite children with their relatives, identify stolen animals, and prove that whale meat has been substituted for fish in sushi. Described below are specific examples of just a few of the ways that DNA has been used.

1. Food Identification. Using portable testing equipment, authorities have used DNA typing to determine that the fish served in sushi was really meat from whales and dolphins. (Angier, Natalie. "DNA Tests Find Meat of Endangered Whales for Sale in Japan." New York Times, National edition, p. A11, Sept. 13, 1994.)

The purity of ground beef (or impurity) has been proven using DNA typing. Hamburger has been shown to be mixed with pork, and other non-beef meat.

2. Accused and convicted felons set free because of DNA typing. A man imprisoned for 10 years was released when DNA testing, unavailable when he was convicted, was used to show that he could not have been the rapist. Statistics show that about one-third of all sexual assault suspects are freed as a result of DNA testing. ("DNA Tests Free Man in Jail for Decade." New York Times, Oct. 22, 1994.)

3. Identifying of human remains. Scientists have used DNA typing to confirm that the body in the grave was (or was not) the person that was supposed to be there. Bones found in Russia are believed to be those of the Romanovs, Russia's last imperial family. Czar Nicholas II and his family were executed by the Bolsheviks in 1918. Experts from around the world have been studying the bones to match skulls, teeth, and other features with photographs. DNA from the bones will be compared to that of known descendants to determine whether the bones do indeed belong to the Czar and his family. ("The Czar's Bones: Britons to Decide". New York Times, Sept. 13, 1992. )

4. Determining relatedness of humans "Iceman Gets Real." Science, Vol. 264:1669. 17 June 1994. DNA typing has shown that the 5000 year old Ice Man found in a melting glacier is most closely related to modern Europeans. This finding "removes all the suspicions that the body was a fraud--that it had been

placed on the ice." says Svante Paabo of the University of Munich. (See Science , Vol. 264:1775. 17 June 1994)

5. Studying relatedness among ancient peoples. DNA found at archeological sites in western Montana is being used to help determine how many related groups of people (families) lived at a particular site. (Morell, Virginia. "Pulling Hair from the Ground." Science Vol. 265:741,5 August 1994.)

6. Identifying families of the "disappeared". DNA testing of families has been used in Argentina to identify the children of at least 9,000 Argentineans who disappeared between 1975 and 1983, abducted by special units of the ruling military and police. Many of the children born to the disappeared adults were kidnapped and adopted by military "parents" who claimed to be their biological parents. Once genetic testing of the extended family revealed the true identity of a child, the child was placed in the home of its biological relatives. It was feared that transferring a child from its military "parents" who were kidnappers, but who had reared the child for years would be agonizing. In practice, the transferred children became integrated into their biological families with minimal trauma. DNA Fingerprints: (J.M. Diamond "Abducted Orphans Identified by Grandpaternity Testing" Nature 327:552-553. 1987.)

7. Identifying organisms that cause disease Eva Harris, a UCSF scientist, is helping scientists in Nicaragua and Ecuador to learn to use DNA technology to detect tuberculosis, identify the dengue virus, and various strains of Leishmania. Other available tests cause waits of many weeks while disease organisms were cultured and sent to foreign labs to be identified. (Marcia Barinaga, "A Personal Technology Transfer Effort in DNA Diagnostics." Science 266:1317-1318. Nov. 25, 1994.)

8. Identifying birth parents. Girls in Florida were discovered to have been switched at birth when one girl died of a hereditary disease. The disease was not in her family, but was known to be in the family of another girl, born in the same hospital and about the same time she was born.

9. Proving paternity. A woman, raped by her employer on Jan. 7, 1943, her 18th birthday, became pregnant. The child knew who her father was, but as long as he lived, he refused to admit being her father. After the man died, DNA testing proved that she was his daughter and she was granted a half of his estate. ("A Child of Rape Wins Award from Estate of her Father." New York Times, July 10, 1994.)

10. Determining effectiveness of bone marrow transplants " DNA fingerprinting can help doctors to monitor bone marrow transplants. Leukemia is a cancer of the bone marrow and the diseased marrow must be removed. But bone marrow makes new blood cells, so the sufferer will die without a transplant of

healthy marrow. Doctors can quickly tell whether the transplant has succeeded by taking DNA fingerprints. If the transplant has worked, a fingerprint from the patient's blood shows the donor's bands. But if the cancerous bone marrow has not been properly destroyed, then the cancerous cells multiply rapidly and the patient's own bands predominate. ("Our Ultimate Identity card in Sickness and in Health," in "Inside Science", New Scientist, Nov. 16, 1991.)

11. Proving relatedness of immigrants. DNA fingerprinting has been used as proof of paternity for immigration purposes. In 1986, Britain's Home Office received 12,000 immigration applications from the wives and children of Bangladeshi and Pakistani men residing in the United Kingdom. The burden of proof is on the applicant, but establishing the family identity can be difficult because of sketchy documentary evidence. Blood tests can also be inconclusive, but DNA fingerprinting results are accepted as proof of paternity by the Home Office. DNA fingerprints (source unknown: Based on A. J. Jeffreys, et al, "Positive Identification of an Immigration Text-Case Using Human DNA Fingerprints", Nature, 317:818-819, 1985 )

12. Confirming relatedness among animals. Scientists who extracted DNA from the hair of chimpanzees from throughout Africa now have evidence that there might be a third species of chimpanzee. At the same time, they have learned things about chimp behavior and kinship patterns that would have once taken years to theorize. They discovered a group of chimps living in western Africa to be genetically distinct from the chimps living in other parts of Africa meaning that the group may be an endangered species. They have discovered that male chimps living in a given area are often as closely related as half-brothers, and many so-called sub-species may all be part of a single species. The male chimps' relatedness may explain why, unlike other primates, the males are quite friendly to each other. ("Genetics Suggest Existence of a Third Species of Chimp." The New York Times, National. Aug. 26, 1994,p. A9.)

13. DNA testing of plant material puts murder at the scene. Two small seed pods caught in the bed of his pick-up truck put an accused murder at the murder scene. Genetic testing showed that DNA in the seed pod exactly matched the DNA of a plant found at the scene of the murder. The accused had admitted he had given the victim a ride, but he denied ever having been near the crime scene. ("Genetic Finger Printing, Seeds of Truth", Popular Science.)

**Time: 10 minutes**

**Materials:**

DNA Autorad X-ray (blue overhead and corresponding print material)

DNA Forensic Case Chart (1/person) (overhead and print material)

**What to do:**

1. Background material and how DNA typing is done can be reviewed with the group at this type.
2. Compare the autorad X-ray to the DNA Forensic Case Chart. It should be apparent that the case chart was taken from the X-ray.
3. By examining their own copies of the DNA Forensic Case Chart, participants should be able to determine who the culprit is according to DNA evidence available.
4. You can now return to steps 7 & 8 in the Beyond a Shadow of a Doubt section and complete the solution to the crime.

## Activity Instructions - Scenario 3

The evidence revealed in this scenario provides inconclusive information to solve the crime. In real crime cases this is often the situation. All suspects were at the crime scene and thus evidence verifying their presence is discovered. However, the evidence does not clearly indicate which suspect is the murderer. In real life, in order to solve the crime, additional evidence may be obtained from witnesses in court. Investigations cannot solely be based on material evidence from the crime scene.

Some preparation will be necessary before the adventure begins for participants.

### **What to do:**

1. In the middle of the room do a masking tape outline of a person; the victim. Beside the outline of the victim place the “murder weapon” (club???), a scrap of paper with a note written on it in ink, a piece of torn material, a foot print (made by the culprit).
2. A “line-up” of suspects must be chosen. It is best if these are chosen from outside of the group who will be participating in the investigation. Four or five is a good number of people. If you are working in a school, perhaps the principal, the vice principal, secretary, another teacher, guidance teacher, etc. could participate as suspects.
3. Take the fingerprints from **ALL** the suspects **RIGHT** hands and place them on separate sheets of paper following instruction from Activity 1. Be sure to label whose prints are whose and keep these in a safe place. (**folder provided to keep evidence from the crime scene**)
4. Preparing the evidence at the crime scene:
  - Take **6** impressions of the each of the suspects shoeprints (one foot will do) following instructions in Activity 2. **It is not important that the suspects wear these same shoes on the day the participants pick them from the line-up as this adds to the reality of the situation.** You may wish to ask all people in the line up to wear similar shoes that day (ie sneakers) to make the choice more difficult.
  - Suspect fingerprints must be made on the “murder weapon”. Pick 3 suspects randomly to put their prints on the weapon. To facilitate a good take of the print, have each of them use some hand cream on their fingertips and then place them on the weapon. Use only the forefinger and the thumb to touch the weapon. **It is very important that the weapon be**

**moved carefully so the prints are not rubbed off or replaced with another person's prints. Put the weapon in the plastic bag provided after the prints are in place.**

- A special pen (contained in the kit) must be "planted" randomly on 1 suspect the day the participants view the line-up.
- A special clothing piece (contained in this kit) must be "planted" randomly on another suspect the day the participants view the line-up. This is important because the note found next to the victim's outline was written with the pen and the piece of torn material matches the one found on the suspect.

#### 5. Preparing your group of participants

- **-Grouping:** Participants should be in groups of 5 or 6.
- -Each participant will receive a detective card (see following page) containing the name of a famous detective, and a cooperative role written on the card. Together the entire groups' detectives will solve the mystery at hand and use the knowledge gained through the activities to determine the culprit.
- -Each participant will receive an Investigator's Journal which will guide them through the activities and to a "solution" to the crime.
- -Participants are now ready to be introduced to the crime scene and read the preliminary report (page 1 - Investigator's Journal). It is most effective if you read this aloud while pointing to evidence at the scene of the crime.

⇒ You're now ready to begin the investigation!!

## **Detective Cards:**

These cards list information on a detective along with a cooperative role for each member of the group. Each participant will be assigned a cooperative role with these cards.

### **Matlock**

A modern-day lawyer and detective, this man searches – inside and out, upside down, backward and forward – to get the answers he needs to clear his clients. **Starter- first person to put materials to use**

### **Sherlock Holmes**

Holmes has more than 50 years of detective experience to his name. He's solves mysteries and crimes from Reno to Rome. **Recorder- records data**

### **Batman**

Yes, he is a detective, and his super powers help him to do an outstanding job. **Getter- Gets and returns Materials**

### **Nancy Drew**

She's an experienced young detective and mystery solver who is able to solve any case that comes her way. **Checker- checks work**

### **Dana Scully (X-Files)**

This FBI Agent and forensic scientist is very suspicious of unusual findings and uses this to get to the bottom of a situation. **Reader- reads instructions, summarizes findings to the rest of the group**

### **Jessica Fletcher (Murder She Wrote)**

This murder mystery writer uses her skills to investigate and solve real murders. **Encourager- provides positive support**

## **Activity 1 : “FOUL PLAY FINGERS” (FINGERPRINTING)**

Fingerprinting is the main method for identifying a person. Fingerprints are the impressions left by the ridges on the tips of the fingers due to sweat excreted by glands and oils picked up by the hands. The patterns on fingers remain unchanged for life, and no two fingerprints are the same. Each person's fingerprints are their own personal signature.

Fingerprints can be classified according to the types of patterns and the number of ridges. There are 3 main types of fingerprints: arches (5% of population), loops (60-65%), whorls (30-35%).

**Time: 40 minutes**

### **Materials:**

talcum powder (leader)  
soft paint brush (leader)  
finger print chart (1 / group)  
roll of transparent tape (1 / group)  
white paper  
hand lens (1 / person)  
pencils

### **What to do:**

1. Pass out paper to each person along with one extra piece per group.
2. One person in each group will rub a pencil on a piece of paper to make a large heavy smudge of graphite (lead).
3. Each participant will rub a finger tip over the smudge until it is silver-coloured.
4. Each participant will stick a short length of tape directly on to the finger tip and will press down.
5. Each participant will peel the tape off of the finger tip and place it on their own piece of paper (plain white), and write which finger it was below the print. The graphite will show the print perfectly through the tape.
6. Repeat steps 2-4 for each finger. Each person will have their own page of prints. Have them print their names on the bottom. (At this point participants usually start to suspect that someone in the room has committed the crime)
7. Have the group examine details of the fingerprints with a magnifying glass and compare prints to those on the fingerprint chart (see following chart).

8. Each participant should write a description of their fingerprint using vocabulary from the fingerprint chart (loop, whorl, arch) on their individual fingerprint paper.
9. Have participants examine and compare each others fingerprints.
10. A discussion about fingerprints and how each person's is different from the next may follow.

### **At the Scene of the Crime**

- Ask the whole group where finger prints might be found at the crime scene
- Carefully pick up the murder weapon and take it out of the bag. Sprinkle it carefully with talcum powder and then brush it with a soft paint brush. Explain to the group that you are attempting to develop latent fingerprints of the culprit. The powder will cling to the natural oil on the prints, outlining them clearly in white. Return the weapon to the bag. (**Do Not disturb the finger prints**)
- Have one or two members of each group examine the prints and return to their groups. (Many participants will wish to compare prints to the print on the weapon at this time. If time permits this can be done. At this time you can let the group know that no one in the room is a suspect for the crime and comparing their fingerprints is unnecessary or you may let them keep wondering if ,indeed, someone in the room has committed the murder.)
- The member will report their observations of the prints to the group so that each participant can record observations of the prints found at the crime scene in the Crime Scene Observations section of the Investigator's Journal. Let them know that it is very important to have detailed records of what they see, where the prints were found as well as what they look like.
- Save the evidence.

# Fingerprint Chart

Compare your prints to the following diagrams:

## **Activity 2 : “Forensic Footprints”**

When police and forensic personal examine the scene of a crime they look closely at any marks possibly left behind by a suspect. Impression marks can be left by tires, shoes, teeth, ... Impression marks can tell a forensic scientist how tall a person is, how they walk and sometimes even what their suspect may look like.

You can easily make a copy of your own footprint and examine what makes your shoe different from the same shoe on another person.

**Time: 20 minutes**

### **Materials:**

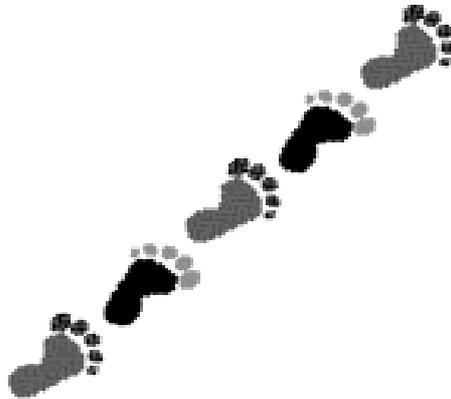
a can of spray oil, such as Pam (1 / group)  
a sheet of plain white paper (1/ person)  
several sheets of newspaper

### **What to do:**

1. Distribute materials to each group.
2. Have one member from each group **lightly** spray the bottom of their shoe with oil and then step on the blank sheet of white paper.
3. Wipe the shoe with newspaper.
4. Let the oil dry a bit and then examine the impression made by the footprint.
5. Discuss what characteristics might be critical to forensic personnel. What makes this shoe print unique? What marks on the print show everyday wear? Can they tell how the person walks? How could you tell the weight and height of a person from the print?
6. If time permits other members of the group can take their prints and examine them.

## **At the Scene of the Crime**

- Pass out copies of the suspects' footprints to each group
- Groups will examine the footprints found at the crime scene.
- Participants will sketch the prints in their Investigator's Journals in the Crime Scene Observations section and pick out any special features of the prints.
- Discuss what the print might tell you about each suspect.
- Save the evidence



### **Activity 3 : “The Marker of a Crime” (Chromatography - Ink Analysis)**

Not often, but sometimes, a suspect will drop something which will provide another clue for forensic scientists. In this case, a note written on with ink. Ink analysis or chromatography is used to discover the brand and type of ink used to type or write on a document.

Black ink is actually a mixture of many different colours or dyes of ink. Different combinations of dyes are found in different brands of ink. Paper chromatography separates these dyes so a forensic scientist can see the amount and saturation of colours in the ink and determine the brand of ink used. In real investigations ink can be carefully removed from evidence and placed on filter paper. Chromatography results are then compared to inks of several different brands and traced back to possible suspects.

**Time: 30 minutes**

**Materials:**

6 different brands of black felt markers **per group**

7 strips chromatography paper **per person**

2 plastic beakers half filled with water **per group**

tape

**What to do:**

1. Distribute materials to groups
2. Using one of the felt markers have a member of each group draw a line approximately 2cm from the bottom of one strip of chromatography paper.
3. Dip the end (and only the end! If the ink touches the water you must start over) of the chromatography paper into the water and wait about 10 minutes. The colours will begin to divide as the water creeps up the paper.
4. Participants will attach the results of each marker in the Chromatography record and write the brand next to it. They will have 6 samples.
5. Have groups compare results with other groups and see if they can determine from the chromatography alone which pens are the same brand.

## **At the Scene of the Crime**

- You will perform paper chromatography on the note found at the scene of the crime which is written on chromatography paper
- Compare the results with those done in the groups. Is it like any of the pens used by the participants?
- Participants will record their observations in the Crime Scene Observation section of the Investigator's Journal.
- Save the evidence.



## **Activity 4 : “Thread Bearing Evidence” (Fiber Analysis)**

Sometimes investigators discover trace evidence at the scene of the crime. Glass, paint and materials fibers are examples of the types of evidence valuable to an investigation.

Fibers are collected and analysed to determine the type of fabric. This may allow a trace to the clothing the suspect was wearing when the crime occurred.

**Time: 30 minutes**

### **Materials:**

5 pieces of same colour fabric  
hand lens (1 / person)

### **What to do:**

1. Distribute materials to groups.
2. Each participant will pull a few threads/fibers from one piece of fabric.
3. Each participant will examine the fibers using the hand lens, touch and unaided vision. Look for texture, thickness of fibers, twist of fibers, transparency of fibers.
4. Each participant will sketch the fiber and write observations.
5. Repeat steps 2 -4 for two more fabrics so that 3 in total will be analysed.
6. Participants will compare the fiber analysis for each fabric.

### **At the Scene of the Crime**

- Provide each participant with a piece of fabric taken from the fabric found at the crime scene
- Participants will analyse this fabric, as in above activity, recording their observations in the Crime Scene Observations section of the Investigator’s Journal.

## **Beyond a Shadow of a Doubt: Choosing the culprit from a line up of suspects**

This is the point where all the evidence collected and analyzed from the crime scene comes into play.

**IMPORTANT**: The 4/5 suspects which you have chosen from outside the group must be available to the group for about 40 minutes. This allows evidence to be compared to the suspects. Plant the pen and the material piece on 2 of the suspects. (Other suspects can have pens and material swatches too to increase the difficulty)

### **Materials:**

Crime Scene Observations section from Investigator's Journal  
Line-up of suspects (4/5 people you have chosen)  
Finger prints of suspects  
Suspect's pen  
Suspects's fabric  
Filter paper  
Plastic glass with water  
Hand lens (1 / person)  
Evidence saved from crime scene folder  
Warrant for arrest

### **What to do:**

1. Set up a table(s) exhibiting evidence taken from the 4/5 suspects. This would include the fingerprints for all suspects, the planted pen and material and any other pens and materials you may wish to add to increase the challenge.
2. Have the evidence saved from the crime scene available.
3. The 4/5 suspects should be brought in and positioned beside the evidence belonging to them.
4. You may ask the group how you should proceed. It may be as follows:
5. The group can begin to analyse the evidence gathered at the crime scene by comparing it to the evidence presented for each suspect.
  - A. A member from each group (ie. MATLOCKS) will examine the fingerprints of **all** suspects and compare to the evidence they recorded in the Crime

Scene Observations. Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal. (Place a check under the suspect whose evidence matches that found at the crime scene)

- B. Another group member (ie. NANCY DREWS) will examine the shoes of **all** the suspects and compare to the evidence they recorded in the Crime Scene Observations. Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal.
  - C. Suspects are asked if they are carrying any pens. Each pen can be analysed using the same procedure in Activity 3. To save time the leader/teacher can do this test and have a member of each group come up and examine the results (SHERLOCK HOLMESs). Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal.
  - D. The piece of material are discovered. Each group should be provided with a few strands of the material to examine using the method in Activity 4. Using these findings each participant will record their conclusions in the Suspect Evidence Table in the Investigator's Journal.
7. Participants will analyse the results recorded in the Suspect Evidence Table and attempt to write a warrant for the arrest of one of the suspects. **The group must agree on a single person to arrest (if this is possible)**. A member from each group (DANA SCULLYs) will stand and read their warrant. If the whole group agrees on the culprit the leader/teacher can fill in the warrant for arrest and give it to the suspect in question. If there is some disagreement discussion must follow and the evidence saved from the crime scene reviewed.
8. It should be evident that there is inconclusive evidence from the crime scene to solve the crime at the present time. Discussion can follow about where other evidence may be gathered.

**Example of results recorded in Suspect Evidence Table for Scenario 3:**

SUSPECT

	A	B	C	D	E
Fingerprint		✓	✓		✓
Footprint	✓	✓	✓	✓	✓
Pen	✓		✓		
Fiber	✓				