

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

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## **Forensics Unit**

### **Module 1: Introduction and Crime Scene Investigation**

#### **Introduction**

In this unit we will focus primarily on forensic science. Forensic science is the use of science to help solve crimes. This could involve the study of blood under a microscope, or the analysis of a victim's stomach contents to see how long he's been dead, and where he might have eaten his last meal. There are many other examples. The key point here is the use of SCIENCE. You will learn about many of the scientific principles investigating officers and forensic scientists use on the job, and some of the technologies they use as well.

#### **The Science of Forensics**

Welcome to Forensics

Thanks to crime shows and movies, the word *forensics* has become a common part of our vocabulary. But what is forensics exactly? Forensics simply means the application of something to a legal situation. For example, computer forensics is the use of computers in a legal situation, such as to help solve a computer crime; forensic photography is the use of photography to document a criminal act. You get the idea.

In this Unit we will focus primarily on *forensic science*. Forensic science - as you've probably guessed - is the use of science to help solve crimes. This could involve the study of blood under a microscope, or the analysis of a victim's stomach contents to see how long he's been dead, and where he might have eaten his last meal. There are many other examples. The key point here is the use of SCIENCE. As you work your way through this Unit, you will learn about many of the scientific principles investigating officers and forensic scientists use on the job, and some of the technologies they use as well.

In this Unit you will be introduced to the world of crime scene investigation and analysis in detail. As you will see, it takes the work of many people - all using science and technology - to help solve a case.

#### **Is The Husband Guilty?**

You're hiking in the woods when you come upon the body of a young woman half hidden in the bushes. Her hair is drenched with blood and she isn't breathing. You call 9-1-1. Soon the authorities arrive on the scene. Emergency personnel check the victim for signs of life. Then the

police tape off the area so no one can get in or out. Identification officers then comb the area for evidence.



Next, the coroner arrives and confirms the victim is dead. Her body is placed in a long plastic bag and is removed from the crime scene. Later, at the morgue, a forensic pathologist examines the body for more evidence and a cause of death. Among other things, he finds a bullet. Later at the lab, firearms experts determine that the bullet was fired from a gun belonging to the victim's husband. A forensic chemist also uncovers

traces of fresh gunpowder on the husband's clothing. Shoeprints from the scene are also found to match the husband's.

Is the husband guilty? It's sure beginning to look like it - the evidence is mounting against him.

The scenario you just read is similar to ones that occur all the time on television: someone is killed or harmed and authorities are called in to solve the case.

TV will have you believe that one or two people can do all the work in a case like this; but in reality, investigating a crime scene, collecting evidence, and examining that evidence requires the combined effort of many people. Each person involved is an expert in a particular field of forensics, often with many years of specialized education and on the job training.

## Crime Scene Investigation Part 1

There are certain procedures that authorities attending a crime scene must follow. The first priority is **preservation of life**: if there is a victim who is severely injured, that person is helped immediately. The attending police officers then **secure the crime scene**. This means removing all unnecessary people from the area and creating a physical barrier so the general public cannot enter. Securing the crime scene prevents physical evidence from being contaminated (e.g., moved, removed, damaged, or altered). Contaminated evidence may ruin the case.

An identification officer is then called in to the crime scene. An identification officer is specially trained to find, document, collect, and sometimes analyze, evidence that has been left behind. The identification officer is like the crime scene investigator you see on television.



Jonathan Sheldon is an identification officer with the Victoria Police Department. As an identification officer, Jonathan performs four main duties. In this lesson you will learn what those duties are.

### *Duty #1: Ensure the Crime Scene is Secure*



When Jonathan arrives at the crime scene, the first thing he does is make sure the area has been properly secured by the first attending police officers. Sometimes Jonathan will instruct these officers to widen or reduce the area that needs to be sealed off. No one can enter or leave this secure area unless Jonathan says so.

### *Duty #2: Search the Crime Scene*

According to Locard's principle of exchange, a suspect always leaves physical evidence at a crime scene.

*Wherever he steps, whatever he touches, whatever he leaves, even unconsciously, will serve as a silent witness against him. Not only his fingerprints or his footprints, but his hair, the fibers from his clothes, the glass he breaks, the tool mark he leaves, the paint he scratches, the blood or semen he deposits or collects. All of these and more, bear mute witness against him.*

--Professor Edmond Locard

After the crime scene is properly secured, an identification officer Jonathan does a thorough visual search for that evidence. Physical evidence may include things like tracks, gunshot residue, drugs, or hair. Jonathan marks the location of each piece of evidence with a numbered card, the following photograph.



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### Did You Know?

An identification officer will be removed from the case if he or she is connected to it in any way (e.g., knows the victim).

### *Duty #3: Document the Evidence*

Next, Jonathan thoroughly documents each piece of evidence. To do this he takes photographs, draws sketches, writes detailed notes, and shoots video. It is important that Jonathan properly document the crime scene for several reasons:

- It creates a detailed record of the crime scene.
- It allows the forensics lab to visualize the crime scene accurately.
- It allows the courts to visualize the crime scene accurately.
- It shows where evidence was found and where it was in relation to other pieces of evidence.



### *Duty #4: Collect and Preserve the Evidence*

Next, Jonathan puts on disposable gloves and carefully collects the evidence. He places the evidence in containers to preserve it. Jonathan labels each container with a detailed description

of what the evidence is and when and where he found it. Jonathan also writes his name on the container so other people will know that he collected it. Jonathan may analyze some of this evidence himself. He will send the rest of it to the forensics lab for testing.

### Chain of Custody

The collection of evidence begins a process called the chain of custody. The chain of custody is a written, witnessed record that describes:

- who handled the evidence.
- when each person handled it (date and time).
- why the evidence was handled.
- what changes, if any, were made to the evidence from the time it was collected until the time it is presented in court.

The chain of custody establishes proof that the evidence that is collected is the same evidence that is presented later in a court of law. If the chain of custody is not maintained, the defense might argue that somebody could have tampered with the evidence. The judge will then generally rule that this evidence cannot be used.

To learn more about Jonathan Sheldon's duties as an identification officer, watch the following video clips:



- [Investigating a Crime Scene](#)
- [Evidence Collection Equipment](#)
- [Chain of Custody](#)

### More on Evidence

As you've learned, the goal of a criminal investigation is to find, collect, and analyze evidence from a crime scene in an effort to solve the crime. That evidence can be categorized as either circumstantial or direct.

Circumstantial evidence suggests that someone is linked to the crime, but it doesn't prove he or she did it. Think back to the crime described at the beginning of this module: In that crime a bullet removed from the victim's body matched ones from her husband's gun. While this may suggest the husband shot her, it doesn't prove it. The evidence is circumstantial because someone else may have fired the gun.

Direct evidence on the other hand, is proof or a fact to do with the crime. For example, if

someone saw the husband shoot his wife, or if he was caught by the police in the act, that would be direct evidence.

In court, **more weight is obviously given to direct evidence**. However, if enough circumstantial evidence can be gathered that points to one suspect, then it's possible the judge or jury can be convinced that the suspect is guilty.

### Summary

In this lesson you learned that authorities follow a specific set of procedures when they investigate a crime scene. Following these procedures precisely is extremely important. If something is done incorrectly, the evidence in question may not be allowed in court and the suspect may not be convicted. For example, if the crime scene area is not properly blocked off from the public, the defense could argue that the suspect had innocently walked through the area before the crime occurred there; his footprints at the scene don't prove he was there when the crime was committed.

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Workbook section: ***Crime Scene Investigation – Part 1***

### Murder on Mayberry Street

1. Identify six procedural errors in the following scenario.

An identification officer is called to the scene of a murder at 231 Mayberry Street. As he pulls up, he realizes it's the home of his daughter's best friend. The officer rushes in and goes to her body. He checks her pulse, but she's dead. She's lying on her side, so he turns her over to see if there's any evidence on her. He notices that she's been shot in the neck. The officer covers her with a blanket, then proceeds to look around the room. He finds a bullet casing, but doesn't touch it. As he bends down to look at it, he notices a gun lying under the dining room table. Carefully, he puts a pen in the muzzle and lifts it up, making sure that he doesn't touch the gun with his fingers. The officer returns the gun to its original position then sits down on the couch to wait for his boss, who will likely be in charge of the investigation.

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_
- f. \_\_\_\_\_

2. The identification officer discovers that the gun belongs to the victim's husband. The husband is now a suspect.

a. Is this information circumstantial evidence or direct evidence against him?

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b. Explain your answer thoroughly.

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3. A hair found at the scene of the crime is matched to the suspect.

a. Is this direct or circumstantial evidence? \_\_\_\_\_

b. Does it prove the suspect was guilty of the crime? \_\_\_\_\_

c. Why or why not?

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4. When collecting evidence from the Mayberry crime scene, it is extremely important that the chain of custody be maintained.

a. What does "chain of custody" mean?

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b. Why is it important to maintain the chain of custody?

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## Crime Scene Investigation Part 2

When investigating a crime scene, an identification officer may find impressions such as footprints, tire tracks, or tool marks (like in the photo below). Impressions can reveal important clues about a crime; therefore, they need to be collected very carefully.



In this lesson you will learn about methods and technologies an identification officer like Jonathan Sheldon will use to collect impressions of footprints and tire tracks left at a crime scene. The first thing Jonathan will do is document the impression (i.e., photograph it and take notes) before making any physical contact with it. Jonathan will then "collect" the impression.



## Collecting Three-Dimensional Impressions

To collect three-dimensional impressions (e.g., footprints in snow or tire tracks in mud), Jonathan will make a cast. To make a cast, he will pour a liquid into the impression then wait for it to harden. When it's removed, the hardened cast provides a copy of the impression.

Jonathan uses a variety of products to create casts. Here are some examples.

### Dental Stone

To make a cast with dental stone, Jonathan sprays a fixative such as shellac or lacquer onto the impression then waits for it to harden. If he finds an impression in snow or ice Jonathan will use snow print wax as a fixative instead; this is to prevent the impression from melting. Next, Jonathan pours dental stone into the impression, waits for it to set, then removes it. Dental stone does not shrink, so it creates an exact copy of the original impression.



### Silicone

If the impression has small cracks or crevices, Jonathan might cast it with silicone. Silicone begins as a paste, but then hardens. When it's solid, silicone is still flexible enough that it can be easily pulled out without breaking.

### Foam

Foam impressions are used most often when trying to match a suspect's footprints with ones found at the crime scene. For a footprint, Jonathan will have the suspect step into a box of soft foam, leaving behind a shoe impression. Jonathan then compares this to the collected print to see if they match.

## Collecting Two-Dimensional Impressions

Collecting a two-dimensional impression (e.g., a dusty shoeprint on a hard floor) is very similar to fingerprinting: Jonathan applies a revealing agent or development medium to the impression then lifts it with special tape or a machine.

### Lifting Materials

**Tape:** After applying the revealing agent, Jonathan may use transparent cellophane tape to lift the print. This method is particularly good on curved surfaces.

**Gelatin Lifters:** A gelatin lifter has a backing with sticky gel on it. Jonathan places the sticky gel over the impression, smooths it, then lifts a copy of the impression. He then places a clear cover over the impression. Although the impression may not be visible to the naked eye, when it is taken to the lab and analyzed under special lighting, the details emerge. Gelatin lifters work well on solid, dry surfaces such as wood floors.

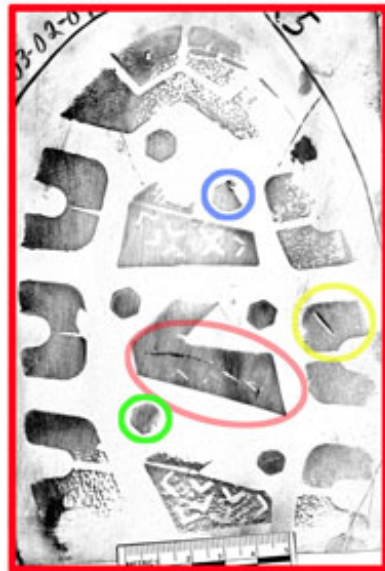
**Electrostatic Lifter:** An electrostatic lifter is a foil sheet with a black back connected to a device that generates a large amount of static electricity. Electrostatic lifters work well on non-porous floors such as wood or linoleum. To use this device, Jonathan shines a light to locate the print. He then places the foil sheet over the surface and applies an electrical charge to it. This causes dust from the print to attach to the foil. Jonathan then removes the foil sheet, and places a transparent cover over the print to preserve it.

### Looking for a Match

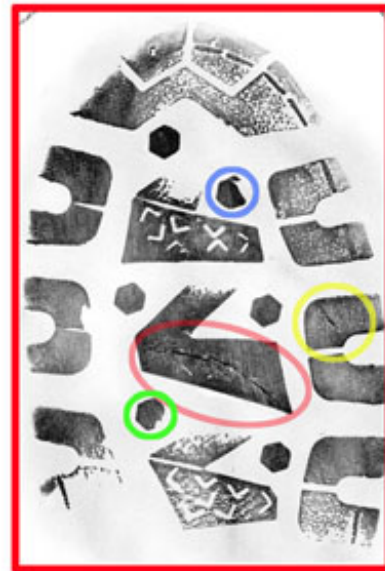
At this point, Jonathan probably will not know what type or brand of shoe made the impression. To find out, he compares his unknown sample against known samples (shoes he can identify) until he locates one that has the same class characteristics. Once he finds a match, Jonathan knows what type and brand of shoe left the impression at the crime scene.

Lots of people will have that same type and brand of shoe in their closet; therefore, any one of dozens or hundreds or perhaps thousands of people potentially could've left that shoeprint at the crime scene. Fortunately, no two person's shoes, even if they are the same type and brand, will leave the exact same impression. That's because every person's shoes has a different wear pattern based on how the person walks, the surfaces the person walked on, how old the shoe is, and so on. All of these things make the soles of your shoe take on what are called accidental characteristics. With this in mind, Jonathan then looks for a specific pair of shoes from the known class that has the same accidental characteristics as the unknown object (e.g., the pair of running shoes with the same nicks and tears on the outsole as on the unknown pair in the

footprint). If he finds a match, Jonathan will conclude that someone wearing the known shoes created the impressions found at the crime scene.



**Unknown**



**Known**

A positive match: these shoes are from the same class and have the same accidental characteristics (circled).

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Workbook section: ***Crime Scene Investigation – Part 2***

### **Making Impressions**

You're an identification officer working the night shift when you are called out to investigate a burglary. A wealthy couple, Harold and Kiran Ronson, had been out for the evening at the opera. Upon returning home, Kiran went upstairs while her husband stopped in the kitchen for a snack. As she entered her bathroom, Kiran surprised a burglar looking for jewels. The thief was dressed in black and had a mask on his face. The burglar saw the diamond necklace around Kiran's neck and grabbed for it. Kiran fought back, and in the struggle, bit the thief hard on the arm. The thief cried out in pain then ran out, knocking down Mr. Ronson in the process.

Later, you stand in the doorway and survey the crime scene. It's time to collect evidence and try to solve the case.

1. The bathroom floor is made of linoleum.

a. Which of these materials would you use to locate and collect shoeprints left on the floor?

- |       |                     |       |                      |
|-------|---------------------|-------|----------------------|
| _____ | camera              | _____ | superglue            |
| _____ | light source        | _____ | aluminum powder      |
| _____ | dental stone        | _____ | cellophane tape      |
| _____ | electrostatic lifts | _____ | snow print wax       |
| _____ | plaster of paris    | _____ | foam impression cast |
| _____ | gelatin lifters     | _____ | silicone             |

b. Why did you choose each of these materials?

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c. How do you use each material?

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2. You lift two different shoeprints from the linoleum floor. One is a from a high heel shoe, the other from a running shoe. Your next task is to try to identify who each of these prints belongs to. We can assume the high heel belongs to Mrs. Ronson, but the running shoe print most likely belongs to the suspect. So far your suspects include Allan the cook, Malik the gardener, and Henry the pool boy. You decide to collect shoeprint impressions from each of these suspects.

a) Which of your three suspects can you **rule out** as the probable attacker? Why?

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b) Look again at the shoeprints from your two remaining suspects. Based on what you now see, which of the two of them would you consider to be the **likely attacker**? Why?

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c) Does the matching shoeprint constitute proof (i.e., direct evidence) that your prime suspect is guilty? Why or why not? Explain your answer.

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3. a) Very important physical evidence can be found on the attacker. What is it? (Hint: think back to how Mrs. Ronson reacted.)

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b) How would you collect this evidence (i.e., what materials and techniques would you use)?

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c) How could you use this evidence to prove the suspect's guilt?

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