The Case of the Murdered Mayor

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Solve a Forensic Case Using Multiple Lines of Evidence

- Entomological evidence
- Hair evidence
- Blood evidence
- Fingerprint evidence
- Impression analysis

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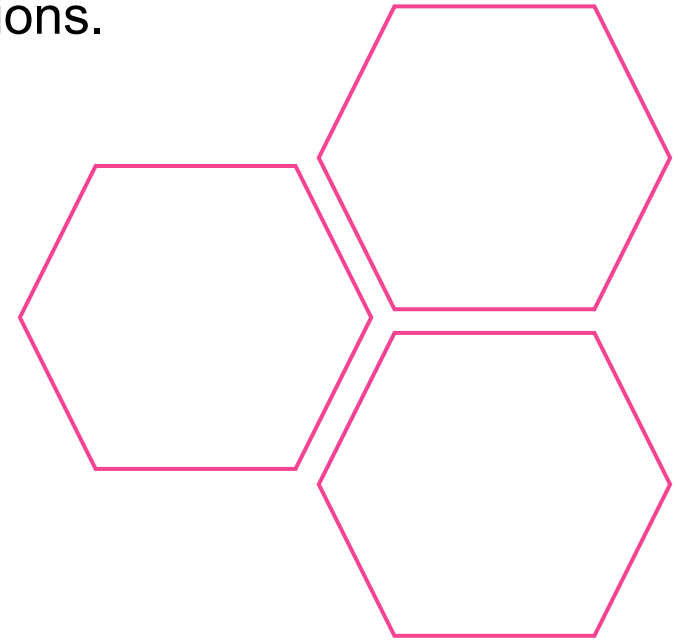
Objectives

- Learn knowledge and skills for conducting forensic investigations with fingerprint, hair, tire impression, blood, and entomological evidence.
- Use analytical skills and deductive reasoning to solve a murder mystery that involves multiple individuals and variables.
- Relate science concepts to forensic investigations.



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Standards

TEKS

- **B.3.C:** Engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.
- **B.12:** The student knows that multicellular organisms are composed of multiple systems that interact to perform complex functions.

CTE

- **HS CTE, Chapter 130.339.C (7) (A):** Demonstrate how to process trace evidence.
- **HS CTE, Chapter 130.339.C (7) (E):** Describe the analysis of trace evidence.
- **HS CTE, Chapter 130.339.C (8) (A):** Compare the three major fingerprint patterns.

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Materials

Blood Evidence (per group)

- Plastic Blood Typing Slides
- Marker
- 10 Dropper Bottles of Synthetic Blood:
  - C. Cunningham
  - M. Maloy
  - P. Preston
  - T. Taylor
  - V. Velto
  - N. Burlington
  - Victim
  - Victim's Car
  - Cabin
  - Tire Iron
- Synthetic Anti-A Serum
- Synthetic Anti-B Serum
- Synthetic Anti-Rh (D) Serum
- Mixing Sticks, Blue
- Mixing Sticks, Yellow
- Mixing Sticks, White

Fingerprint Evidence (per group)

- Fingerprint Evidence Slides (skipped during workshop)
- Magnetic Fingerprinting Powder
- Fingerprinting Powder Applicator (magnetic stem with clear plastic sleeve)
- Fingerprint Lifting Tape
- Dual Magnifiers
- Unlined White Index Cards

Entomological Evidence (per group)

- 12 Artificial Maggots
- Small Cups
- Rulers

The Case of the Murdered Mayor Kit

Item #699830

Hair Evidence (per group)

Note: *Data is provided during workshop in place of performing experiment.*

- Hair Evidence in Labeled Envelopes
- Microscope Slides
- Coverslips
- Dissecting Forceps
- 3-mL Plastic Pipets and Water
- Microscopes

Impression Analysis (per group)

- Copy of the Impression Evidence Sheet

The Case of the Murdered Mayor Kit Refill

Item #699830R

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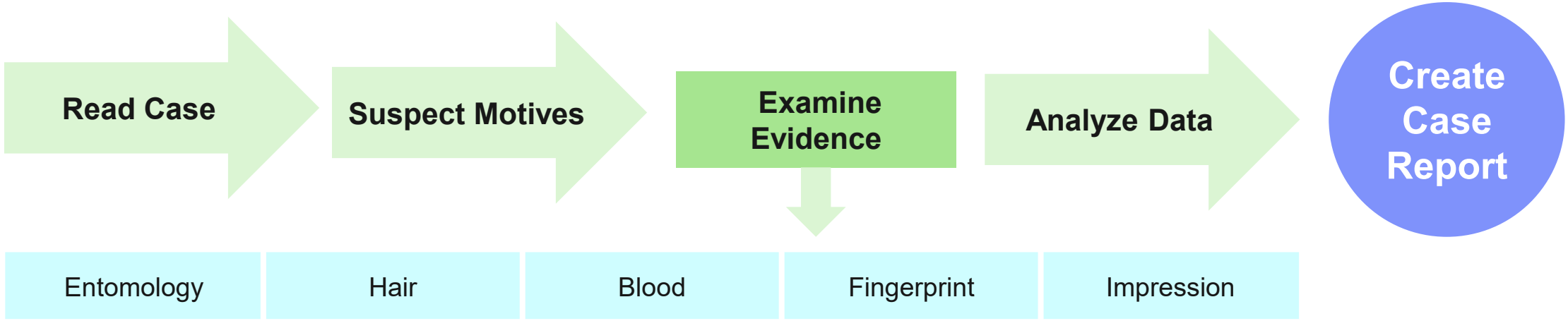
Lab Flow



To maximize the limited time of our workshop, we will:

- Summarize the case
- Skip motives
- Perform modified versions of each activity

You will leave with enough evidence to solve the case!

Time Requirements

Teacher Preparation..... 90 minutes
Prelab..... 30 minutes
Laboratory Investigation..... 90 minutes
Assessment..... 30 minutes
Presentations (optional)..... 60 minutes

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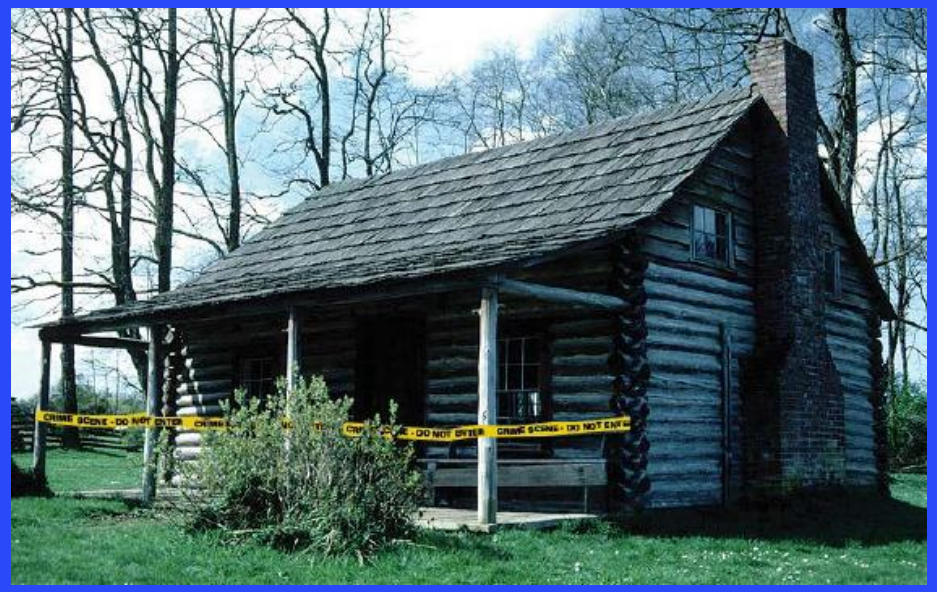
Pages 2 & 3



Suspects:

Timothy Taylor
Pam Preston
Matthew Maloy
Vic Velto
Chris Cunningham

Victim:

Mayor Robert Burlington

The Case

The residents of Allenville celebrated the election of **Robert Burlington as mayor** against **incumbent mayor Timothy Taylor**. Though a number of people spoke out against him during the campaign (including local environmentalist **Pam Preston**), Burlington won by a narrow margin.

Rumors began to circulate that Mayor Burlington was taking bribes from businessmen lobbying to build an industrial park in Allenville. Concerned citizens **Matthew Maloy and Vic Velto** started a petition to remove the mayor from office but failed to get enough signatures.

The mayor was heard arguing with his wife **Nicole Burlington**, who was observed driving through town in a new car and wearing an expensive fur coat the following day. During the latest town council meeting, councilman **Chris Cunningham** publicly accused the mayor of lying and taking bribes, to which the mayor responded by abruptly ending the meeting and storming out of the building.

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Pages 2 & 3

The Case

Five days after the town council meeting, Burlington's car was found on a road near Lake Larson. The mayor was not there, but his keys were in the ignition. **Several drops of blood were found** on the front seat. A tire iron, smudged with blood, was found in the woods near the car. A second **set of tire tracks** near the mayor's car followed a muddy road to a deserted cabin deeper in the woods.

Inside the cabin, a glass window was shattered and the furniture was scattered and broken, suggesting a struggle had taken place. **Mayor Robert Burlington lay on his side, a single bullet hole in his chest.** He also had a large wound on the back of his head. It was apparent that **he had been dead for a while**; the stench of decay was present and maggot activity was evident on the body.

The investigators gathered five different types of evidence for comparison and further analysis.

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1. Entomological Evidence

Pages 6 & 14

Investigators collected insect larvae from the victim's head and chest wound sites.

Forensic entomologists can **determine the approximate time of death** by examining the size of larvae, which emerge from eggs laid on the body within minutes of death.

Activity 1:

1. Obtain 12 maggots and rulers.
2. Identify the largest 8 and separate from the other larvae.
3. Measure each larva (1 per person) and determine the average length in millimeters.
4. Using the Fly Larvae Growth Chart, identify the estimated days since death.
5. Record your estimation in table 2 on page 14.

Fly Larvae Growth Chart	
Average size of most mature larvae (mm)	Estimated days since death
1-2	1
3-5	2
6-8	3
9-11	4
12-14	5
15-18	6
19-21	7
22-25	8
26-28	9
29-31	10
32-33	11
Pupation occurs	12

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2. Hair Evidence

Pages 7, 8, & 14

At the crime scene, investigators collected samples of hair from the victim's clothing, the victim's car, and the cabin floor.

Hair samples from the vehicles of the suspects have been collected and identified. This information is available to you on page 14 in table 2.

Your team will analyze the hair samples found at the crime scene and compare them with the evidence from the suspects' vehicles.

Animal Hair
(thick medulla)

Human Hair
(absent medulla)

Activity 2:

1. Identify the three hair samples (see the handout) as either animal hair or human hair.
2. Record your identification in table 1 on page 14 and for the victim in table 2.
3. Compare your results in table 1 to the identification for each suspect's car found in table 2. Record matches and nonmatches.

Note: In the classroom, students would prepare wet mounts with real hair samples for analysis.

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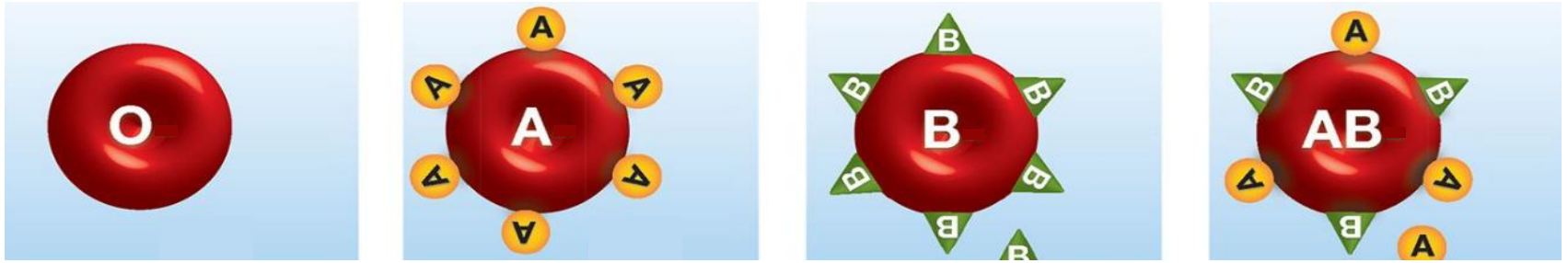
3. Blood Evidence

Pages 8, 9, & 14

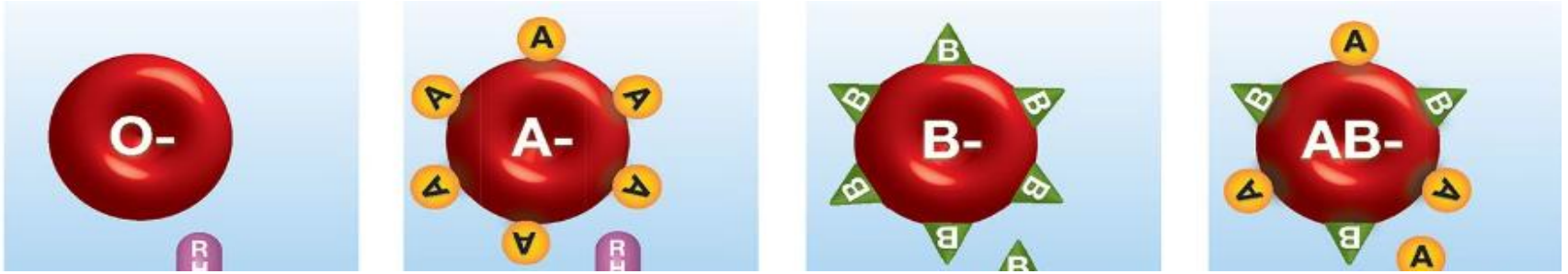
What are the different major blood types?

What causes these types?

Two different molecules called agglutinogens, type A and type B, are attached to the surface of the red blood cells.



The presence or absence of RH protein determines whether a type is positive (+) or negative (-).



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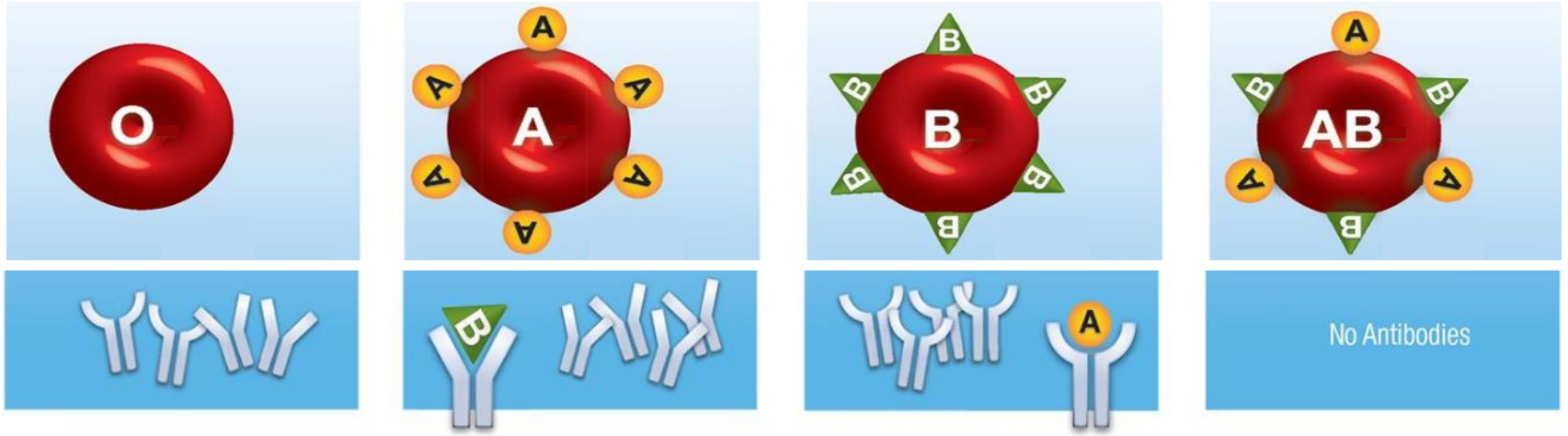
3. Blood Evidence

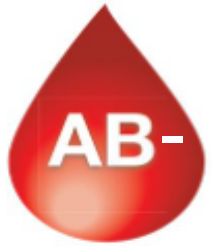
Pages 8, 9, & 14

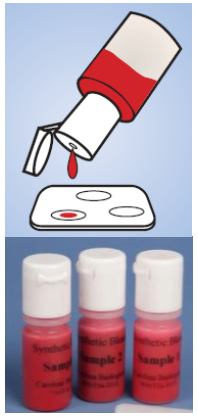
How can we test to identify different blood types?

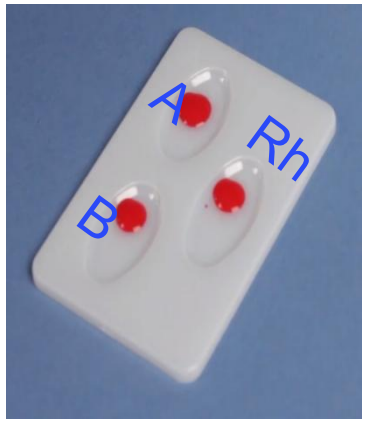


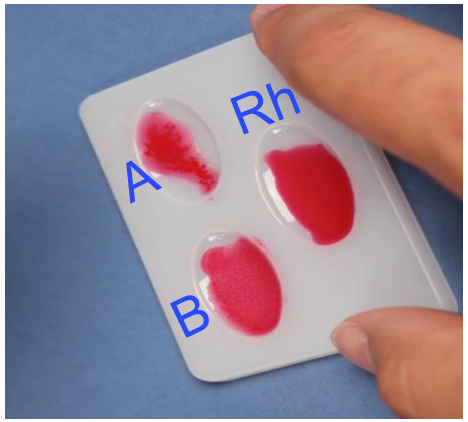
Your body produces antibodies to protect against antigens. Antibodies in your blood recognize antigens on blood cells.

What blood type does this card identify?









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3. Blood Evidence

Pages 8, 9, & 14

Investigators collected samples of blood from the victim, the victim's car, the cabin floor, and the tire iron. Each of the six suspects also submitted a blood sample for analysis.
Your team will perform blood typing to identify the blood type for all 10 samples.

Activity 3:

1. Each group obtains 10 blood samples, anti serums (anti a, b, and Rh), blood typing trays, and colored toothpicks.
2. To test 10 samples, each person will test 1 blood sample. Two people will test 2 blood samples.
3. Use a permanent marker to label the blood-typing slide with the source or name of the blood sample(s) you will test.

ABO Blood Groups

Blood Group	Red Cell Antigen	Serum Antibody in Plasma	Anti-A serum test results (coagulation?)	Anti-B serum test results (coagulation?)
A	A	Anti-B	Yes	No
B	B	Anti-A	No	Yes
AB	A and B	Neither	Yes	Yes
O	Neither	Both Anti-A and Anti-B	No	No

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3. Blood Evidence

Pages 8, 9, & 14

Activity 3 (continued):

4. **Place one drop of the synthetic blood sample in each of the three wells** of the blood-typing slide. Close the cap on the dropper bottle.
5. **Add one drop of synthetic anti-A serum (blue) to well A**. Close the cap.
6. **Add one drop of synthetic anti-B serum (yellow) to well B**. Close the cap.
7. **Add one drop of synthetic anti-Rh serum (clear) to well Rh**. Close the cap.
8. Use a different colored mixing stick to stir each well; use blue for anti-A, yellow for anti-B, and white for anti-Rh. **Gently stir the synthetic blood and anti-serum drops for 15-45 seconds each.**
9. Examine the liquid mixture. **If you see evidence of a reaction (namely, clumping of the liquid), there is agglutination. If a liquid mixture remains uniform in appearance, there is no agglutination.** In the appropriate table, answer “yes” or “no” as to whether or not agglutination occurred.
10. **Record the blood typing result for the sample in your Evidence Tables on page 14.**

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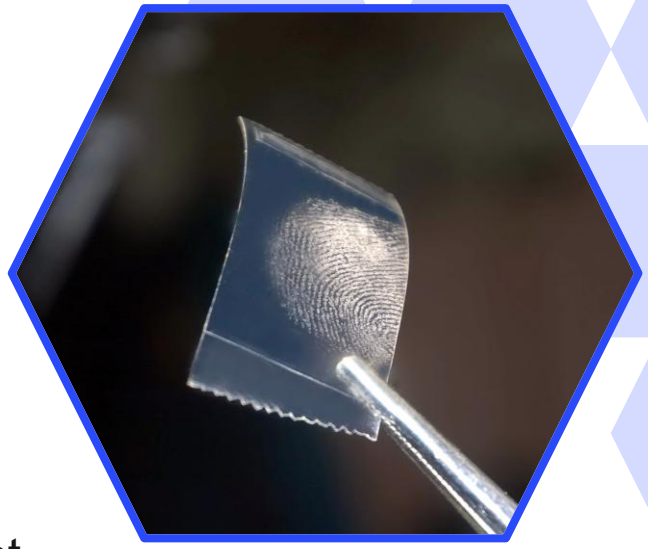
4. Fingerprint Evidence

Pages 10, 11, & 14



Investigators obtained fingerprint samples from the victim, from a piece of broken glass in the cabin, from a doorknob in the cabin, and from the tire iron.

Later, all six suspects provided a fingerprint sample on a microscope slide. Your team will lift and transfer several fingerprints, and other teams will do likewise.

In the classroom, students are provided with a set of 10 prepared fingerprint slides to perform the lift on. **For the purposes of our workshop, you are provided with the data that would have been observed on these 10 slides.**

Instead, we will practice lifting and identifying fingerprints by creating a slide of your own print, lifting it, and identifying it, following the procedure below.

Activity 4:

1. Obtain a microscope slide, being careful to handle it by the edge.
2. Rub your forehead or run your fingers through your hair to increase the oil content of your fingerprints. Then gently touch the center of the first slide with one finger and slightly roll the finger.

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4. Fingerprint Evidence Pages 10, 11, & 14

Activity 4 (continued):

3. Locate the plastic fingerprint powder applicator. Insert the magnetic stem (rod) into the clear plastic applicator sleeve.
4. Dip this assembly into the jar of magnetic fingerprinting powder. Collect a quantity of powder on the end of the applicator.
5. Brush the powder lightly over the fingerprint on the slide, completely covering it. Return the remaining powder to the jar by holding the applicator over (or just inside) the mouth of the jar and moving the magnet in and out past the cover flare until all of the powder releases.
6. With the magnet inserted, use the applicator to pick up any excess powder not adhering to the fingerprint. Release the powder back into the jar as you did in the previous step. Pick up the slide by its short edges. Turn the slide 90 degrees and gently tap it to remove any excess powder.
7. Attach a piece of adhesive tape to the print on the slide and peel it off.
8. Attach the tape to an unlined white index card.
9. Examine your fingerprint with your hand lens. Use the fingerprint reference sheet on page 11 to identify the patterns of your fingerprint.

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5. Impression Evidence

Pages 12, 13, & 14

Investigators photographed the tire impression found at the cabin crime scene. Later, they photographed the tires of vehicles belonging to the suspects.

Crime Scene Tire Impression

Chris Cunningham

Matthew Maloy

Pam Preston

Timothy Taylor

Vic Velto

Nicole Burlington

Activity 5:

1. Study the photo of the tire impression from the crime scene and compare it to the photographs taken of each vehicle's tire treads (page 13). If necessary, use a hand lens to help you see a greater level of detail.
2. Try to determine which tread matches the tire impression found at the crime scene.
3. Add this information to your evidence data tables on page 14.

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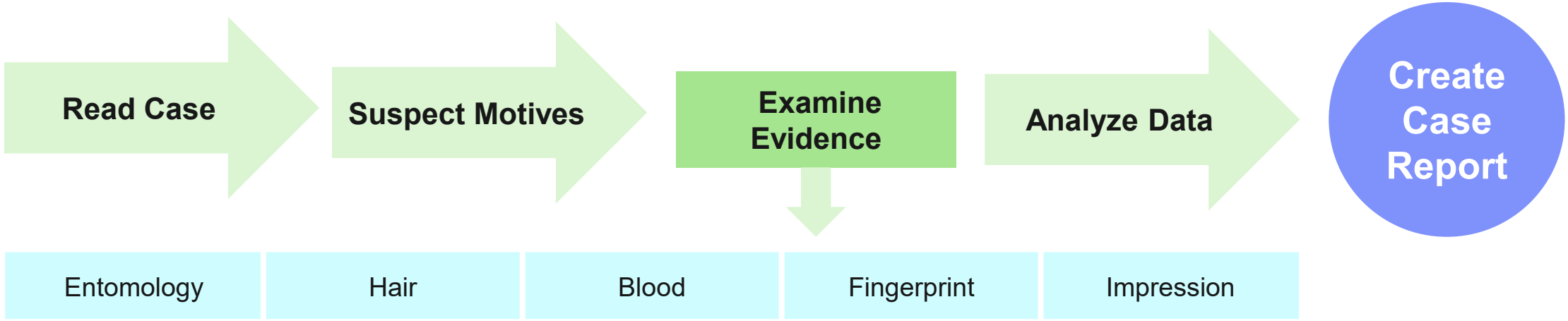
Lab Flow



To solve the case now, all that remains is to:

- Examine and identify suspect motives and alibis on pages 4 and 5.
- Analyze the data you have collected on page 14 and create a case report on page 15.

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DA Report

After agreeing upon the suspect(s) and motive(s), prepare a written report of your findings, along with documentation supporting your reasoning. **Your report should include the following information:**

1. A summary of all of the evidence collected. Describe the different types of evidence collected, and the process by which each piece of evidence was examined.
2. Give a detailed statement of the results of each analysis. Support all statements with specifics from the data you collected.
3. Name your primary suspect(s). How does the forensic evidence incriminate the suspect(s)? How does information from the police detective's report mesh with the physical evidence to support the innocence or guilt of the suspects?
4. What do you think happened? Describe the most likely series of events leading up to and following the mayor's death, as indicated by the evidence.
5. What additional information is necessary to further this investigation? What additional work could be done to extend or improve this investigation?

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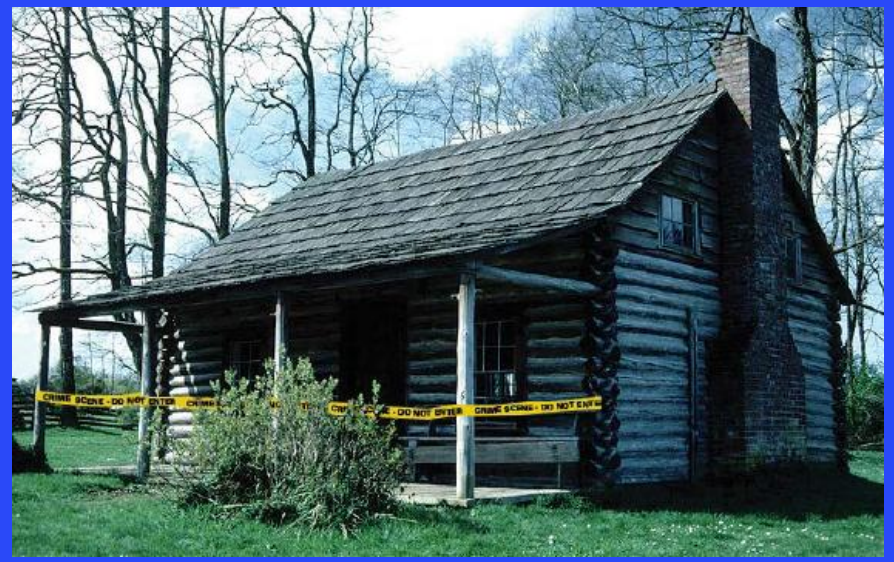
Who Murdered the Mayor?

Submit your answer for a chance to win either The Case of the Murdered Mayor Kit OR a Carolina® Crime Scene Bundle!

This QR code is at our booth as well!



Suspects:

Timothy Taylor
Pam Preston
Matthew Maloy
Vic Velto
Chris Cunningham

Victim:

Mayor Robert Burlington

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