Blood splatter

Contributors

Ashlin Reid
Graduate Student
Georgia Southern University, GA

Cynthia Dean
Partner Teacher
Effingham, GA

Intended Audience

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>K-4</td>
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<tr>
<td>5-8</td>
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<tr>
<td>9-12</td>
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</table>

Activity Characteristics

<table>
<thead>
<tr>
<th>Classroom Setting</th>
<th></th>
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<tbody>
<tr>
<td>Requires special equipment</td>
<td></td>
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<tr>
<td>Uses hands-on manipulatives</td>
<td>X</td>
</tr>
<tr>
<td>Requires mathematical skills</td>
<td>X</td>
</tr>
<tr>
<td>Can be performed individually</td>
<td></td>
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<tr>
<td>Requires group work</td>
<td></td>
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<tr>
<td>Requires more than one (45 min class) period</td>
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<tr>
<td>Appropriate for special needs student</td>
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</table>
Introduction

Description

In this lab activity, students will compare and contrast medium and high velocity impact spatter. Students will be provided with an introduction to impact blood spatters and then they will create their own in the lab.

Abstract

Bloodstain pattern analysis is a powerful forensic tool used in crime scene investigations. In this activity students will investigate the difference in average diameters of blood drops between high and medium velocity impact bloodstain patterns.

Core Themes Addressed

<table>
<thead>
<tr>
<th>Microbial Cell Biology</th>
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<tbody>
<tr>
<td>Microbial Genetics</td>
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<tr>
<td>Microorganisms and Humans</td>
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<tr>
<td>Microorganisms and the Environment</td>
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<td>Microbial Evolution and Diversity</td>
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<tr>
<td>Other</td>
<td>X</td>
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</tbody>
</table>

Keywords

Medium impact spatter, High impact spatter, diameter

Learning Objectives

At completion of this activity, learner will

1. Compare and contrast medium and high velocity impact blood spatter
2. Compare and contrast 90° angle and non-90° angle blood spatter

National Science Education Standards Addressed

Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry
Teacher Handout

Blood Spatter

Student Prior Knowledge

Students should have the following knowledge prior to completing this activity:

1. Be able to recognize the importance of bloodstain patterns.
2. Be able to recognize certain weapons that make high and medium velocity impact bloodstain patterns.

Teacher Background Information

Bloodstain pattern analysis is a powerful forensic tool used in crime scene investigations. If the investigator understands the dynamics of an altercation, how blood behaves when it exits the body, and how it reacts when it contacts a surface, then an attempt can be made to understand what happened and to determine if a crime occurred. The trained forensic scientist looks at the spatter patterns made by shed blood and tries to determine what did and/or did not happen. Interpreting the bloodstain patterns involves physical measurement of blood droplets, pattern recognition using known photographs or experiments, the use of trigonometry, and knowledge of the physics of motion. Bloodstains cannot always be carried back to the lab so care in documenting the scene is of utmost importance.

Class Time

This activity will require a minimum of one 50 minute class period.

1. Introduction PowerPoint – 10 minutes
2. Lab Activity – 35 minutes
3. Wrap up questions/Review – 5 minutes

Teacher Preparation Time

This lesson will require approximately 30 minutes preparation time to prepare the simulated blood and cut the butcher paper.

Fake blood recipe:

- 3 cups water
- 3 tablespoons of corn starch
- ½ cup of corn syrup
- 1 tablespoon cocoa powder
• 4 drops of red food coloring

Materials and Equipment (2 per group)

1. Simulated blood
2. Butcher paper
3. Toothbrush
4. Gloves
5. Tape

Methods

1. Provide a blood spatter overview (PowerPoint).
2. Generate groups with two students per group.
3. Give each group one set of activity materials: simulated blood, butcher paper, toothbrush, tape, and pair of gloves.
4. In this activity, students will:
   a. Use hands and a toothbrush to create high and medium velocity impact patterns.
   b. Measure diameters of at least four blood drops for each blood spatter pattern and calculate the average diameter.
   c. Paste a small sample of each pattern onto their lab data sheet.
   d. Compare and contrast high and medium velocity impact patterns.
5. As a wrap up, facilitate student discussion on how knowing whether a bloodstain pattern is high or medium velocity can help investigators.

Tips/Suggestions

1. Give a pair of gloves to the student making the medium and high blood impact spatter.
2. Complete the bloodstain patterns outside and then bring the butcher paper inside to complete the measurements.

References

This activity was modified from: WARDS Natural Science
Answers to Student Handouts

A. Medium velocity impact spatter has blood drops that have a larger diameter than high velocity spatter. Students should include the average diameters that they collected today in lab in their answers.

B. At a 90 degree angle the blood spatter pattern is grouped more closely together. At a non-90 degree angle the blood spatter pattern is more spread out. As long as the student uses data and observations they collected in lab today you should accept the answer.

C. Knowing what kind of impact was made at the scene of the crime could help the investigator figure out possible weapons used. Knowing the angle could help the investigator recreate the crime and possibly tell if the suspect was standing, lying, or sitting.
Introduction

Bloodstain pattern analysis is a powerful forensic tool used in crime scene investigations. If the investigator understands the dynamics of an altercation, how blood behaves when it exits the body, and how it reacts when it contacts a surface, then an attempt can be made to understand what happened and to determine if a crime occurred. Today you will be examining medium and high velocity impact spatter.

Student Background Knowledge

Students should have the following knowledge prior to completing this activity:

1. Be able to recognize the importance of bloodstain patterns.
2. Be able to recognize certain weapons that make high and medium velocity impact bloodstain patterns.

Vocabulary

**Angle of Impact:** The angle at which a blood droplet strikes a surface.

**High Velocity Impact Spatter:** The bloodstain pattern caused by a high velocity impact/force to a blood source such as that produced by gunshot or high speed machinery.

**Medium Velocity Impact Spatter:** the bloodstain pattern caused by a medium velocity impact/force to a blood source. A beating typically causes the type of spatter.

**Spatter:** bloodstains created from the application of force or energy to the area where the blood originated.

Materials Checklist

<table>
<thead>
<tr>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td>Simulated blood</td>
</tr>
<tr>
<td>Butcher paper</td>
</tr>
<tr>
<td>Toothbrush</td>
</tr>
<tr>
<td>Tape</td>
</tr>
<tr>
<td>Pair of gloves</td>
</tr>
</tbody>
</table>
Procedure

a. Use hands and a toothbrush to create high and medium velocity impact patterns.
b. Measure diameters of at least four blood drops for each blood splatter pattern and calculate the average diameter.
c. Paste a small sample of each pattern onto their lab data sheet.
d. Compare and contrast high and medium velocity impact patterns.

Examples of student-created medium and high impact blood spatter patterns.
Student Worksheet

Blood Spatter

Instructions:

Medium Velocity Impact Spatter:

1. Label the butcher paper in the upper right-hand corner with your group names and lab period.
2. Position your hand horizontally approximately 1 foot from the butcher paper with the palm side down with the finger parallel to the paper.
3. Place a small pool (about the size of a quarter) of simulated blood on the top of your hand.
4. Using the fingers of your other hand, slap the hand with the pool of blood pushing your fingers forward in a perpendicular orientation to the target surface (Figure 1).

![Figure 1](image)

5. Carefully remove the butcher paper with the bloodstain and label it as “Medium Velocity Impact Spatter, 90 degree angle” and set it aside to dry.
6. Repeat steps 2-4 above, except slap the horizontal bloodied hand with your fingers at an angle OTHER THAN 90 DEGREES.
7. Carefully remove the butcher paper with the bloodstain and label it as “Medium Velocity Impact spatter, non-90 degree angle” and set it aside to dry.
8. When the bloodstains are dry measure the diameter of the smaller stains and calculate an average diameter and put it in the appropriate box in Data Table 1.
9. When you are finished measuring cut out a small section of each stain pattern and put it in the appropriate box in Data Table 2.

High Velocity Impact Spatter

1. Label the butcher paper in the upper right-hand corner with your group names and lab period.
2. Using a toothbrush, cover the top tips of the brush with simulated blood.
3. Aim the brush directly at the butcher paper perpendicular to the surface and rub your finger across the tips from front to back. The pattern will be very light and blood drops small.
4. Repeat the process in Steps 1-3 above, but this time orient your brush AT AN ANGLE to the target surface.
5. Carefully remove the butcher paper with the bloodstain and label it as “High Velocity Impact Spatter, 90 degrees” and “High Velocity Impact Spatter, non-90 degrees.” Allow the stains to dry.
6. When the bloodstains are dry measure the diameter of the smaller stains and calculate an average diameter and put it in the appropriate box in Data Table 1.
7. When you are finished measuring, cut out a small section of each stain pattern and put it in the appropriate box in Data Table 2 if it is dry. If the stain pattern is wet, then draw a description of what the spatter looks like.

Data Table 1

<table>
<thead>
<tr>
<th>Velocity Impact</th>
<th>Diameters</th>
<th>Average Diameters</th>
<th>Spatter drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium, 90 degrees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium, non-90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High, 90 degrees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High, non-90 degrees</td>
<td></td>
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</tbody>
</table>

Data Table 2

<p>| Medium Velocity Impact Spatter 90 degrees | High Velocity Impact Spatter 90 degrees |</p>
<table>
<thead>
<tr>
<th>Medium Velocity Impact Spatter</th>
<th>High Velocity Impact Spatter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-90 degrees</td>
<td>Non-90 degrees</td>
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</table>

Questions:

A. How do the blood spatter patterns differ between high and medium velocity? Use at least two sentences and the evidence that you created today to answer this question.

B. How can you tell if the blood spatter pattern was made at a 90 degree angle or a non-90 degree angle? Use at least two sentences and the evidence that you created today to answer this question.

C. How can knowing what kind of impact (high vs. medium or different angles) made a blood spatter pattern help crime investigators? Use at least two sentences and the evidence that you created today to answer this question.