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| **Project 1.1.6: Blood Spatter Analysis** |

Introduction

Blood can be a very powerful form of evidence. Blood typing and DNA evidence provide crucial pieces of information, but bloodstain patterns left at a crime scene can also be very useful as they can help investigators establish the events that took place during the crime. For example, the bloodstain pattern can give you information about the possible weapon used and the location of the blood source (also called the *point of origin*). Bloodstain pattern can also help investigators distinguish between an accident and foul play. If two similar-sized blood droplets fall from different heights, the resulting stains will have different sizes. Therefore, the height from which a blood droplet falls can be determined based on the size of the bloodstain. Bloodstain analysis is a form of forensic science known as *blood spatter analysis*.

A crime scene investigator specializing in blood spatter analysis has already done the preliminary work for you. The analyst has determined that the bloodstains found next to Anna’s body resulted from an impact angle of 90°, meaning that the blood dropped directly from above. When a droplet of blood strikes a horizontal surface at 90°, it produces a circular stain. It is your job to determine the height from which the blood fell based upon the crime scene bloodstain patterns. Using what you have learned in the previous activity about experimental design, you will design your own experiment to investigate how height affects bloodstain patterns. Use your results to determine if Anna got hit standing up if she was hit on her way down. Remember, your evidence will need to stand up in court!

Equipment

* Computer
* Laboratory journal
* PBS Course File
* Unit 1 – Investigative Notes Resource Sheet
* Goggles
* Gloves
* Project 1.1.6 Student Response Sheet
* Experimental Design Resource Sheet
* Time of Death Experimental Design Resource Sheet
* Height Determination Graph student response sheet
* Possible materials for experiment:
  + Pipette or bottle with eye-dropper
  + Micropipettor
  + Stand and clamp
  + Meter stick or measuring tape
  + Simulated blood
  + White paper
  + Paper towels
* Career Journal
* Career Journal Guidelines
* Documentation Protocol

Procedure

Part I: Blood Spatter

1. Refer to your Experimental Design Resource Sheet and your Time of Death Experimental Design Resource Sheet as needed throughout the project.
2. Obtain a Project 1.1.6 Student Response Sheet from your teacher.
3. Read through both experiments and answer the corresponding questions on the Student Response Sheet.
4. Compare the design of both experiments and discuss differences as a class.
5. View the Discovery Communications video on Blood Spatter available at <http://science.discovery.com/tv-shows/science-channel-presents/videos/discoveries-this-week-blood-splatter.htm>. Pay attention to how scientists can set up and analyze experiments looking at patterns of blood at a crime scene.
6. Obtain a Height Determination Graph student response sheet.
7. Note that in this project, you will work with a partner to design an experiment to investigate how height affects bloodstain patterns. Remember that you are trying to determine if Anna was hit while she was standing or if she was hit on her way down. Use the Experimental Design resource sheet as your guide as you design. Document key information about your experiment in your laboratory journal.
8. Add a Heading in your laboratory journal that says *Blood Spatter Analysis Lab*.
9. Follow Step 1 of the Experimental Design Resource sheet to write a problem statement for your experiment.
10. Follow Step 2 to write a hypothesis for your experiment as well as identify the independent and dependent variables.
11. Follow Step 3 and design your experiment. Make sure that in your experimental design, you always release the droplets from a 90° angle. You may use the following materials, but you are not limited to just these materials. You do not have to use all of the items listed below.

* Pipette or bottle with eye-dropper
* Micropipettor
* Ring stand and clamp
* Meter stick or measuring tape
* Simulated blood
* White paper
* Paper towels

1. As you design, think about factors that you need to control in your experiment. For example, how can you control the volume of blood used in each trial run?
2. Clearly write your experimental design in your laboratory journal.
3. Share your experimental design with another group. Critique the other group’s experimental design and provide meaningful feedback on ways to improve the experiment.
4. Use the feedback obtained to improve your experimental design.
5. Have your experiment approved by your teacher and Follow Step 4 to carry out your experiment. Record all observations and results in your laboratory journal.
6. Follow Step 5 to analyze your data. Graph your results on the Height Determination Graph student response sheet.
7. Share your graph with the class.
8. Obtain a copy of the blood spatters found at the scene of the crime from your teacher. Measure the blood spatters and record this information in your laboratory journal.
9. Use your Height Determination Graph to determine the height from which the blood fell based upon the crime scene bloodstain patterns. Include a copy of your Height Determination Graph in your laboratory journal.
10. Based on your analysis, follow Step 6 to write a conclusion to your experiment.
11. Use your laboratory results to hypothesize what you think occurred at the crime scene that resulted in the bloodstain patterns. Record your theory on your Unit 1 - Investigative Notes sheet.
12. Note that a scientist who specializes in analyzing blood left at a scene is called a *blood spatter analyst*. Follow the Career Journal Guidelines and complete an entry in your Career Journal for a blood spatter analyst.
13. Follow the *Biomedical Sciences Documentation Protocol* to correctly document or cite the sources of information you used.

**Part II: Classroom Evidence Board**

1. Note that you will keep a classroom evidence board to track the case of Anna Garcia throughout the *entire course*. Continue to add information to this board at the conclusion of each lesson. Your teacher may assign you or teams of two to a specific lesson. You will be responsible for summarizing findings from the lesson, adding information to the board, and facilitating a class discussion about the key findings from the lesson and how these findings shape current theories of how Anna ultimately died.
2. Work as a class to design your Evidence Board and complete the first entry using information from Lesson 1.1 NOTE: This information will be updated and changed as the course goes on. Possible headings include:
   * Evidence from the scene
   * Relevant medical history
   * Autopsy findings
   * Possible theories
3. Answer the Conclusion questions.

Conclusion

1. How did you control any external variables in your experiment?
2. If a violent murder occurred as the result of the killer wielding a weapon over his or her head or from side to side would result in a line of blood spots on the ceiling or walls, similar patterns on walls could be the result of the victim being flung across the room. If the victim crawled on the floor or the body was dragged, then there would be smears or trails on the floor. Smudges, smears, bloody fingerprints or handprints on furniture or doors could indicate a struggle in the room. Based on the blood spatter patterns found at Anna’s house, what do you think happened?
3. Describe how the biomedical science professional introduced in this activity would assist with Anna’s case.