



# Case File:ELCA10

## *Dropped at the Scene: Blood spatter analysis*

Analyze blood spatter evidence and help identify Jessica Barnes' killer.

### Re: Police Detective Status: Barnes Murder

Museum curator Jessica Barnes was found dead on 10/05/07, the day before the grand opening of the world famous traveling exhibit Shadows of Egypt. Her body was found at the base of the large marble fountain in the center of the museum lobby.

It was clear that the victim was strangled. A few drops of blood were found on the tile floor, but blood tests show that the blood is not the victim's. Investigators have found traces of the same blood on the knuckles of the victim's hand. Investigators are suggesting that she fought her attacker, giving him or her a bloody nose or lip, and that the blood dripped onto the floor as the attacker fled the scene.

The small volume of blood suggests that the wound was minor and, thus, would have nearly healed by the time the suspects were apprehended. Indeed, none of the prime suspects showed evidence of a facial injury of any kind.

We may be able to narrow down the height of the killer from the blood spatter evidence. (We need this to order blood tests.)

### Barnes Murder Suspect List

Three other museum employees were working after hours the night Ms.

Barnes was killed:

Abraham Stein, photo archivist: 6'2"/ brown eyes/ brown hair

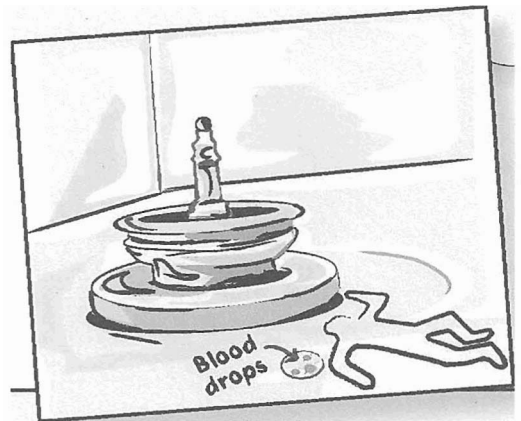
- knew Barnes was trying to cut funding for his vintage photo department

Ellie Walsh, museum curator: 5'3"/ green eyes/ brown hair

- was a candidate for the head curator position six months ago, along with Barnes—Barnes given position

Keith Hartman, administrative assistant: 5'8"/ blue eyes/ bleached blond hair

- was recently fired by Barnes and finishing his remaining two weeks in the position



## Forensics Objective

- determine the height of a source of blood spatters or drops



## Science and Mathematics Objectives

- graph data to find quantitative relationships
- create a standard reference curve for comparison with unknown data



## Materials (for each group)

- TI-83/TI-84 Plus™ Family
- newspaper
- 13 pieces of white paper
- disposable pipettes or droppers
- simulated blood
- calipers, or compass and metric ruler
- meterstick



## Procedure

### Part I: Collecting the Data

Create blood spatters from known heights and compare them with unknown samples.

- Spread newspaper on the ground. Place a piece of white paper on the newspaper.
  - Fill a pipette with simulated blood. Drop a single drop onto the white paper from a height of 10 cm.
  - Measure the diameter of the spatter in millimeters, using calipers or a compass. (Note: If the spatter has a ragged edge, measure *only* the diameter of the main blood drop; do *not* include any ragged edges in your measurement.) Record the diameter in the Evidence Record, along with any observations you can make about the shape of the spatter.
  - Repeat steps 1b and 1c twice more, moving the pipette to slightly different locations but maintaining a height of 10 cm.
  - Calculate the average diameter of the spatter that fell from 10 cm, and record it in the Evidence Record.
  - Replace the white paper with a clean sheet. Repeat steps 1b–1e from a height of 20 cm.
  - Repeat step 1f for each remaining height in the Evidence Record.
  - Now measure the diameter of each spatter in the crime scene evidence, calculate the average diameter of the crime scene spatters, and enter the data into the Evidence Record.
2. Enter the height and diameter data into lists in your calculator.
- Press **STAT** **ENTER** to enter the data list editor.



If there are old data in any of the lists, clear them by using the arrow keys to select the list heading (L1, L2, etc.) and then pressing **CLEAR** **ENTER**.

- In list L1, enter the heights that the drops fell.
- Enter the average diameter of the spatters in list L2. (Do *not* enter the data from the crime scene into the lists.)

### Part II: Analyzing the Data

3. Start your analysis by graphing the drop height versus the average spatter diameter.
- Press **2nd** **Y=** to enter the Stat Plot menu.

Make sure all the other graphs are turned off before you plot your data. To turn off all other plots, select option **4: PlotsOff** before proceeding with step 3b.

- Choose **Plot1** by pressing **ENTER**. On the resulting screen, turn on the plot by using the arrow keys and pressing **ENTER** when **On** is highlighted.
- Choose a dot (scatter) graph, the first of the pictured graphs, by using the arrow keys and pressing **ENTER** when the first pictured graph is highlighted.
- Plot the heights of the drops on the x-axis by selecting L1 (press **2nd** **1**) for the **Xlist**.

Plot the diameters of the splatters on the y-axis by selecting L2 (press **2nd** **2**) for the **Ylist**. Press **ENTER**.

- e) To set the scaling values for the graph window, press **ZOOM**. Select option **9: Zoom Stat** to have the calculator automatically set the window scaling to fit your data.
- f) Examine the graph of your data points. Do they seem to fall along a straight line or a curve?



# Case ELCA10: Dropped at the Scene

NAME: \_\_\_\_\_  
DATE: \_\_\_\_\_

## Evidence Record

Height (cm)	Diameter of Drop 1 (mm)	Diameter of Drop 2 (mm)	Diameter of Drop 3 (mm)	Average Diameter of Drops (mm)	Shape and General Observations of Blood Splatters
10					
20					
30					
40					
50					
60					
80					
100					
120					
140					
160					
180					
200					
Crime Scene					

## Case Analysis

1. Did the shape of the blood splatters change as the height increased? Explain.
2. Which of the suspects could have created the blood splatters at the crime scene? Explain.
3. How accurate do you think your height estimate is? What factors can contribute to inaccuracy in your estimate? How can you reduce the errors from these factors?
4. Forensic scientists often do tests to determine the relationship between height and spatter diameter for the different cases they are involved in. What factors can cause the relationship between height and spatter diameter to differ from crime scene to crime scene?



Case File: ELCA 10  
Suspect's Blood

