Blood Spatter - History

- 1894 - Pitoroski wrote earliest reference to blood-spatter analysis
- In 1939, Balthazard was first to analyze the meaning of the spatter pattern.
- In 1971, Dr. Herbert MacDonnell used blood spatter as a tool in modern forensic examination

Blood Spatter Analysis

- When a wound is inflicted, a blood spatter pattern may be created.
- It takes a grouping of blood stains to make a blood spatter pattern.
- The pattern can help to reconstruct the events surrounding a shooting, stabbing, or beating.

Blood Spatter Analysis

Analysis of a spatter pattern can aid in determining the:
- direction blood traveled.
- angle of impact.
- point of origin of the blood.
- velocity of the blood.
- manner of death.

Blood Spatter Analysis

- Blood is a thick mixture of cells and plasma.
- gravity, cohesion, adhesion and surface tension act on the blood droplets.
- gravity pulls blood down and the droplet elongates.
- because blood is cohesive it is attracted to itself and tends to stick together instead of separating.

Blood Spatter Analysis

- If blood falls on a flat surface, its cohesiveness causing the blood to pull together and resist flattening out, so the top has a spherical appearance similar to water droplets.

Blood Spatter Analysis

- When blood falls from a height or at a high velocity, it can overcome its natural cohesiveness and form satellite droplets.
  - Textured surfaces produces more satellites
- When it falls onto a less-than-smooth surface, it can form spiking patterns around the drops.
- Notice that spikes are still connected to the main drop while satellites are completely separated.
Blood Spatter Analysis—Six Patterns

1902, Dr. John Glaister described 6 patterns:

a. passive drops—falling straight down (90°) produces circular drops
b. arterial gushes—walls or ceilings produced by pumping action of the heart
c. splashes—shaped like exclamation points; used to determine position of the victim
d. smears—left when victim or suspect touches surface
e. trails—left when person moves; drops, gushes or smears
f. pools—person remains in one place bleeding heavily

Blood Spatter Analysis—Impact

Patterns can help investigators determine the type of weapon used:
• Gunshot or other high velocity impacts produce a fine-mist pattern
• Beating with a weapon produces a lower-velocity pattern with cast-offs
• Voids (empty spaces) in the pattern help determine the presence of a person or object moved after the attack

Blood Spatter Analysis—Origin

Using the pattern, examiner can determine the angle of impact or convergence, a two-dimensional representation of the location of the victim at the time of the injury.
• Point of origin - three dimensional view formed using lines of convergence and angles of impact of at least two different drops of blood to identify the source and location of blood spatter - determined by the mathematical relationship between the length and width of the drops

Blood Spatter Analysis—Directionality

• As moving blood strikes a surface, cohesion, adhesion and surface tension affect its shape - adhesion is the force between two unlike things such as the blood and the wall.
  - surface tension is an elastic characteristic along the outer edge of a liquid caused by cohesion - the attraction of like molecules
• blood tends to adhere to the surface so the point of impact of the drop is darker and wider than the rest of the drop
• Momentum keeps blood moving in the same direction it was traveling
• As drops move, they elongate and may produce a thin tail-like appearance which points in the direction of movement
• Satellites may break off and will appear in front of the moving drop.

Blood Spatter Analysis—Location of the Origin of the Blood

Lines of convergence
• Draw straight lines down the axis of the blood splatters.
• The blood originated where the lines converge.
Crime Scene Investigation of Blood

1. If evidence is discovered, determine if it is blood:
   - Kastle-Meyer test will turn dark pink with blood
   - Leukomalachite will turn green with blood
2. Determine whether the blood is human:
   - ELISA test (Enzyme Linked Immunosorbent Assay) uses antibody-protein reaction similar to blood typing but with different antibodies
   - Human blood is injected into a rabbit, etc to produce antibodies against human blood which are then isolated and stored.
   - The antibodies react when mixed with human blood

3. The blood type - class evidence.

   - Interpret the findings:
   - See if the blood type matches a suspect.
   - If it does not, exclude that suspect.
   - If it does, decide if DNA profiling is needed.

• Even if area is cleaned, blood evidence remains
• Red blood cells contain hemoglobin which has iron
• Luminol powder is mixed with hydrogen peroxide and sprayed in the area.
• Iron in the hemoglobin acts as a catalyst to speed up the reaction between the peroxide and Luminol producing light for about 30 seconds
• Luminol detects blood in darkened rooms or at night and works best in areas where someone attempted to clean up the blood
• Blood evidence can remain for years

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