Chapter 4: Bloodstain Analysis

I. Understanding Blood Properties

Importance of Blood Evidence

The shape & location of bloodstains provide clues about where victim & suspect were when the crime took place & where they went afterward. Blood also reveals the presence of disease, drugs, or alcohol as well as DNA.

Chemical Properties of Blood

Blood is medium responsible for the transport of nutrients & wastes throughout the body. Blood is a mixture of the following cellular & liquid components:

1) **Blood Cells:** red blood cells are the most numerous, primarily responsible for the transport of gasses (O_2 & CO_2). White blood cells are responsible for fighting infection. Platelets are responsible for forming clots to aid in the repair of damaged blood vessels.
2) **Plasma:** composed mostly of water, plasma is the liquid portion of blood. Suspended within the plasma are blood cells, nutrients, wastes, & various proteins (some involved in clotting).

Blood Typing

Figure 1: ABO Blood Types

Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)	 A agglutinogens only	 B agglutinogens only	 A and B agglutinogens	 No agglutinogens
Plasma Antibodies (phenotype)	 b agglutinin only	 a agglutinin only	 No agglutinin	 a and b agglutinin

Blood Type: _____

_____

a) Remember that blood type is a form of *class evidence* that cannot be linked to a specific person, but rather a group of people. This blood type alone cannot be used to identify a particular suspect.

Understanding Blood Clotting

Blood Clotting: _____

_____

a) Serum is the liquid that remains after clotting proteins have done their job, whereupon the blood has retracted into a solid clump.

Investigators can use the *state of blood clotting* as a rough guide *to estimate how much time has passed* since the blood was shed:

1) **Liquid Blood**: bleeding occurred only minutes before.
2) **Shiny, Gelatinous Blood**: bleeding occurred less than an hour before.
3) **Clotted Blood & Serum**: bleeding must have occurred several hours earlier.

II. Analyzing Bloodstain Patterns

What Can Bloodstains Tell Us?

Depending on the situation, blood can drip, ooze, flow, gush, or spurt. This may lead to the death of an individual by way of ***Exsanguination***.

Exsanguination: _____

_____

Each type of blood movement (dripping, oozing, etc) leaves a recognizable bloodstain pattern or ***Spatter***. The information that such bloodstain spatters provide includes:

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

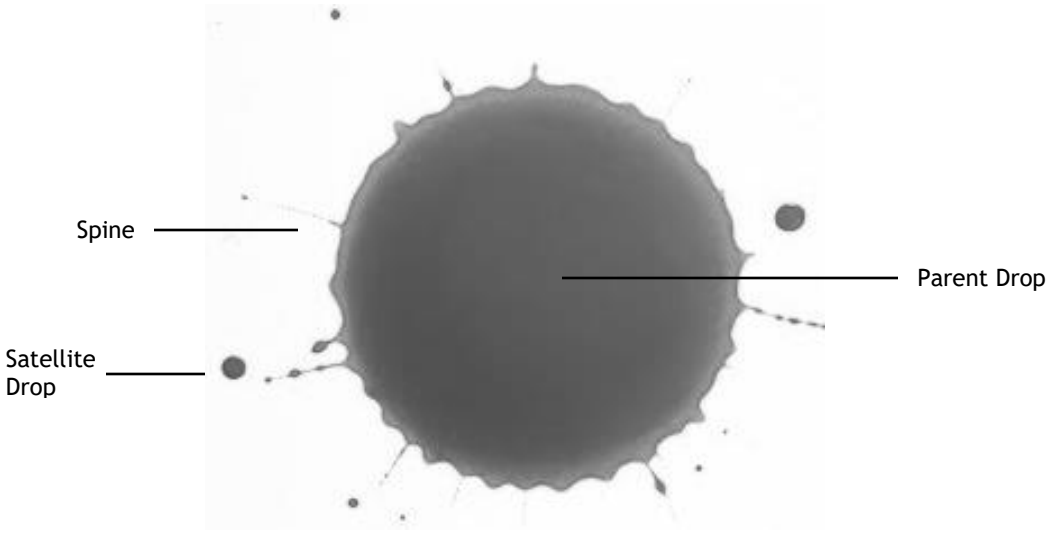
Blood spatter patterns can be classified based on the velocity at which they strike a surface. The three main types of spatter patterns include: *Low, Medium, & High velocity patterns*.

Low Velocity Blood Spatters

Low Velocity Spatter: _____

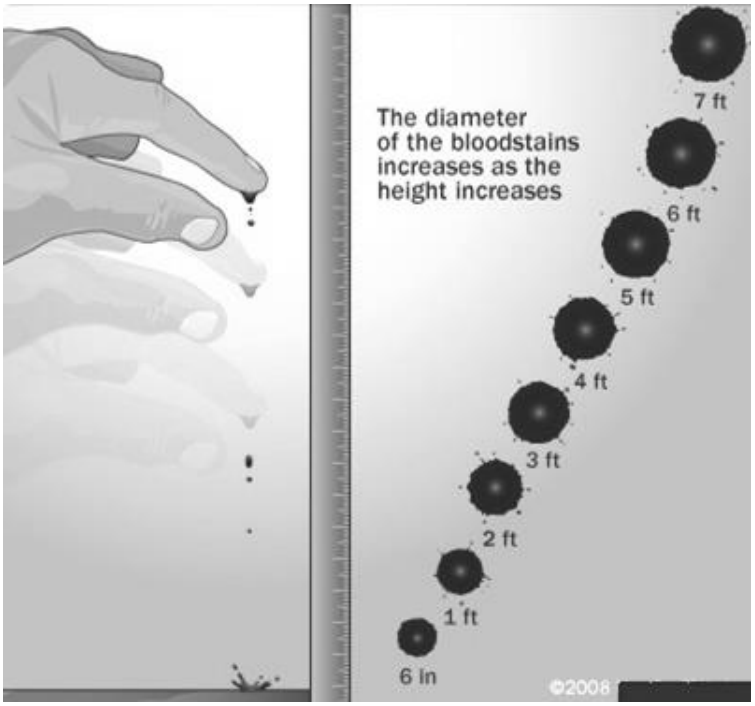
_____

a) Generally occur as blood drips from an injured person's wounds, a blood-covered weapon, or any elevated object whereupon *gravity alone* pulls droplets downward.
b) Low velocity spatter consists of *spherical drops* with smaller, ***Satellite Drops*** formed at it makes contact with a surface. Linear Spines extend outward from the drop (length directly proportional to the speed that the drop impacted the surface):



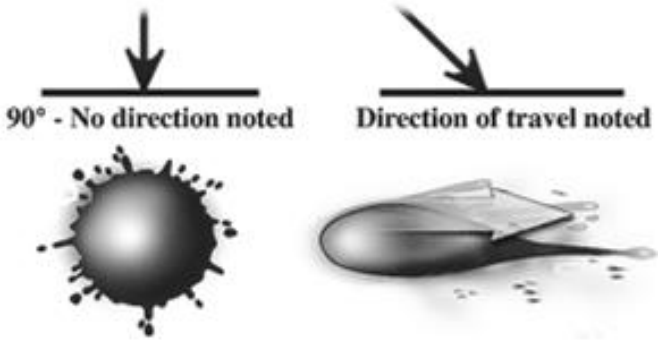
c) The diameter of the drop is *directly proportional* to the distance from which the drop fell, up to a height of SEVEN feet (at this point air resistance prevents the drop from traveling any faster & the diameter does not significantly change).

Figure 2: Spatter Diameter vs Height (& Velocity)



d) As seen in figure 3, when a drop strikes a surface at a 90 degree angle, the spatter pattern forms a *even circle* around the point of impact. If the blood strikes from a smaller angle, the spatter creates *elongated oval patterns* with the *narrow end* aiming in the direction the drop was traveling.

Figure 3: Spatter Patterns vs Impact Angle



To summarize, the shape & size of low velocity (passive) spatter patterns depend on the following variables:

1) _____

2) _____

3) _____

4) _____

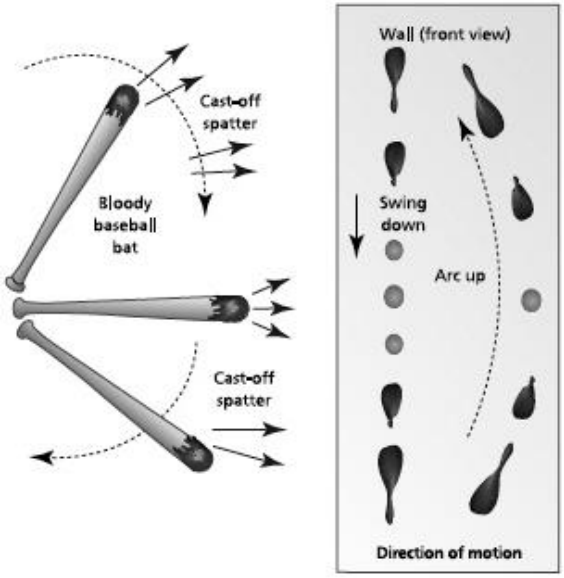
Medium & High Velocity Blood Spatters
Medium to High Velocity patterns result from blood that is *projected from a victim* due to the application some force *greater than that of gravity*.

Medium Velocity Spatter: _____

_____

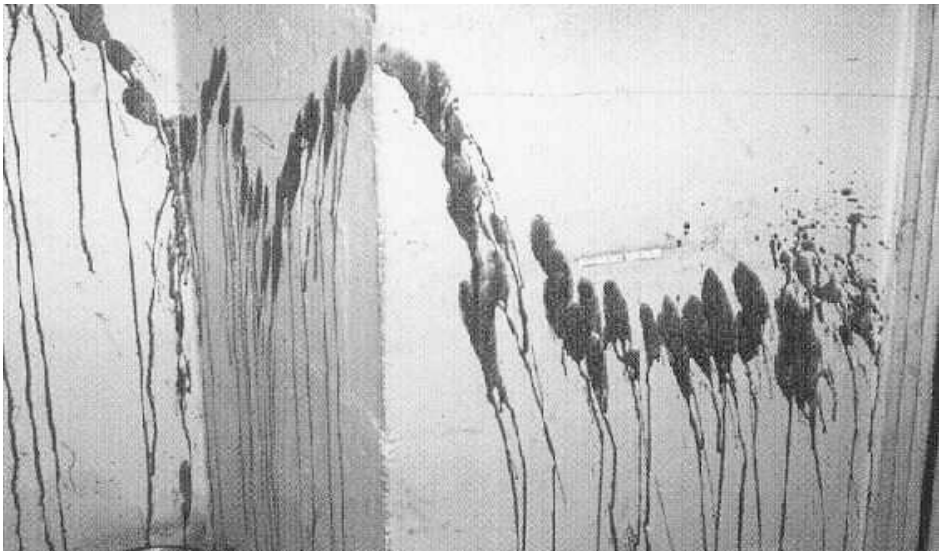
Castoff Spatters are created when blood is flung from an object moving in an arc (fist, bat, pipe, etc) Can provide information as to position & height of the assailant during the crime.

Figure 4: Cast Off Spatter



Arterial Spatters occur when *an injury to an artery or the heart itself* causes blood to spurt out of the body. The site of the initial injury can be detected by noting where the spurt is the largest

Figure 5: Arterial Blood Spatter

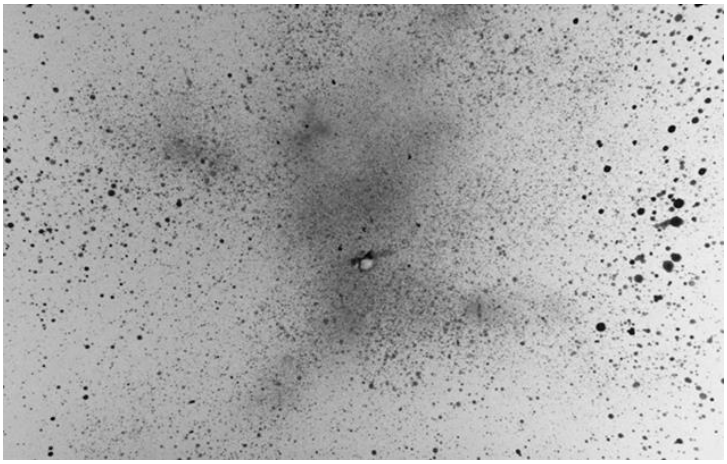


Expirated Spatter is created when blood is expelled from the *mouth or the nose of a victim*. Indicated by presence of O_2 bubbles or a lighter color due to dilution with saliva.

High Velocity Spatter: _____

_____

Figure 6: High Velocity Spatter



Void Patterns may be created when an object (or person) blocks the deposition of spatter onto a surface. Can provide information as to the *size & shape* of the missing object or person. May also provide information as to the position of the victim & assailant during the crime.

III. Determining Where the Crime Occurred
Points of Convergence & Origin

When examining a spatter pattern, investigators can use the angle at which droplets impact a surface & their direction of movement to make the following determinations:

Point of Convergence: _____

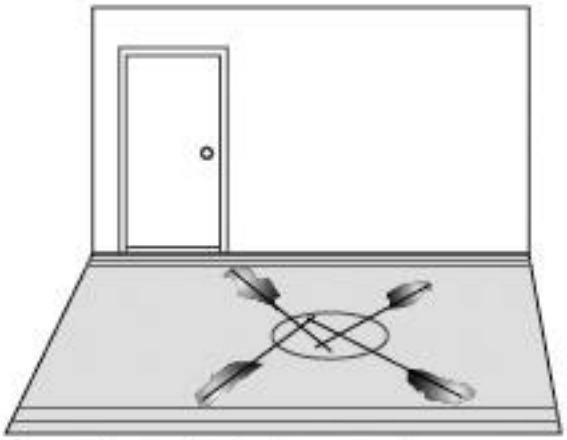
_____

Point of Origin: _____

_____

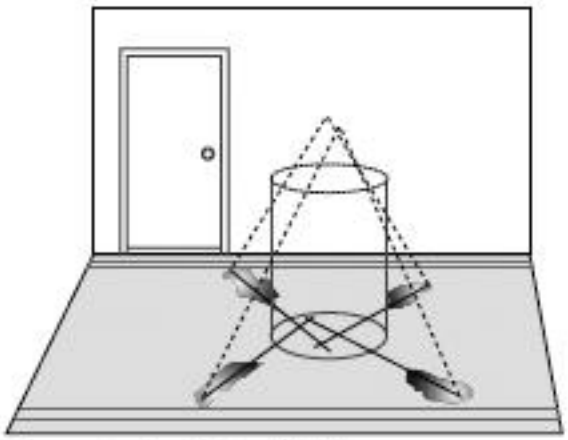
Figure 7: Point of Convergence vs Origin

Point of Convergence



2-D reconstruction (point of convergence)

Point of Origin



3-D reconstruction (point of origin)