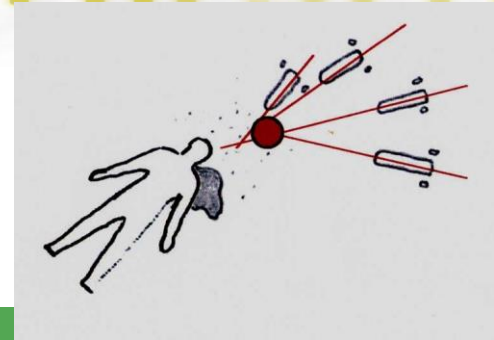




Blood Spatter



- 1894 – Pitoroski wrote earliest reference to blood spatter analysis.
- 1939—spatter patterns first analyzed by Balthazard (**speed of blood influences shape of the stain**)
- Blood may spatter when a wound is inflicted
- Blood spatter pattern—a grouping of blood stains
- Patterns 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 Evidence

- Class evidence for blood would include blood type. If you can determine the DNA you would have individual evidence.
- **Blood stain patterns** are considered **circumstantial evidence** in a court room. Experts could argue many points including direction of stains, height of the perpetrator, position of the victim, left/right hand, whether the body was moved, etc. (usually only used to enhance the argument)

BLOOD DROPLET

Characteristics



- A blood droplet will remain spherical in space until it drops onto a surface
- Once a blood droplet impacts a surface, a bloodstain is formed.
- A droplet falling from the same height, hitting the same surface at the same angle, will produce a stain with the same basic shape.

BLOOD DROPLET Volume



- Is approximately 0.05 cc
- Is not the same for all blood droplets--from 0.03 cc to 0.15 cc
- Is directly dependent upon the surface or orifice from which it originates
- The impact area is called the target.

CONDITIONS EFFECTING BLOODSTAIN SHAPE



1. Size of the droplet
2. Angle of impact
3. Velocity at which the blood droplet left the original surface
4. Texture of the target surface
 - On clean glass or plastic--droplet will have smooth outside edges
 - On a rough surface--will produce scalloping on the edges



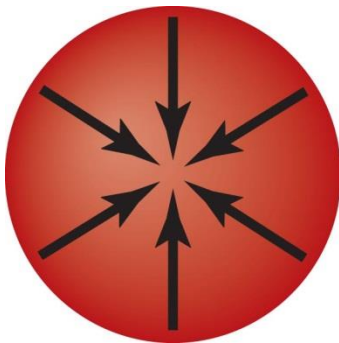
Blood Splatter Analysis

Natural cohesiveness of blood – causes a blood droplet to fall in a spherical shape.

Remember, over half of blood is water

Cohesion: Water is attracted to water

Adhesion: Water is attracted to other substances



IMPACT

- o The more acute the angle of impact, the more elongated the stain.
- o 90 degree angles are perfectly round with 80 degree angles taking on a more elliptical shape.

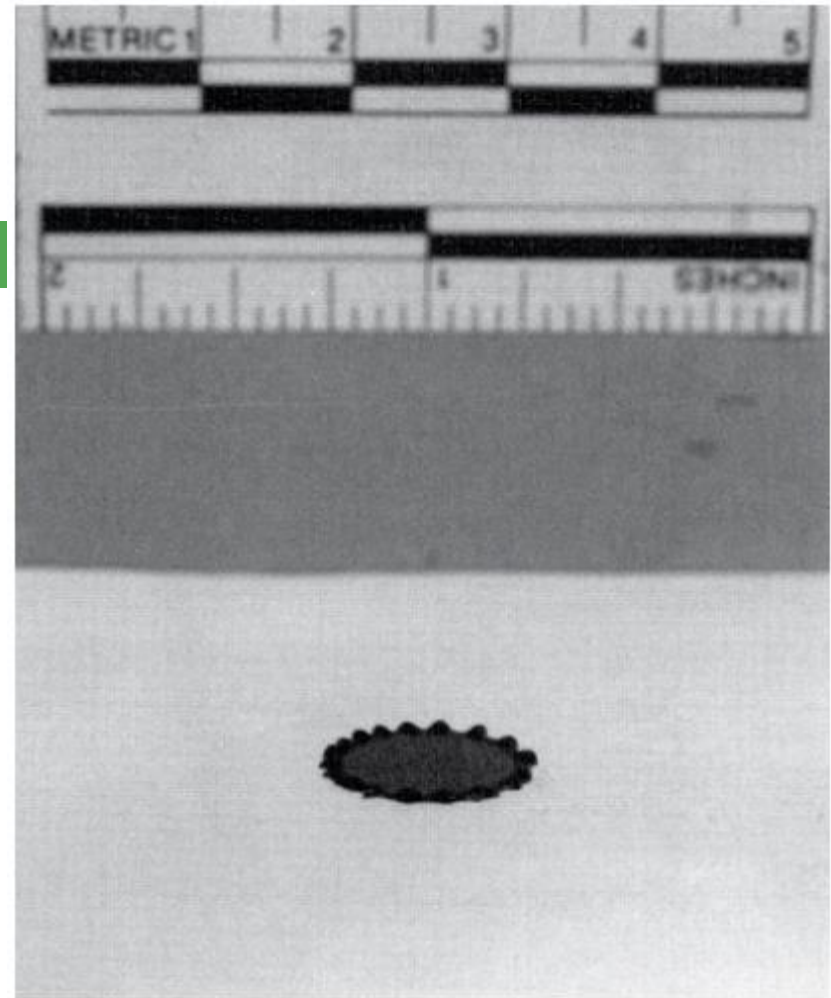


Figure 6: Displacement phase of a blood droplet in a 90° impact.

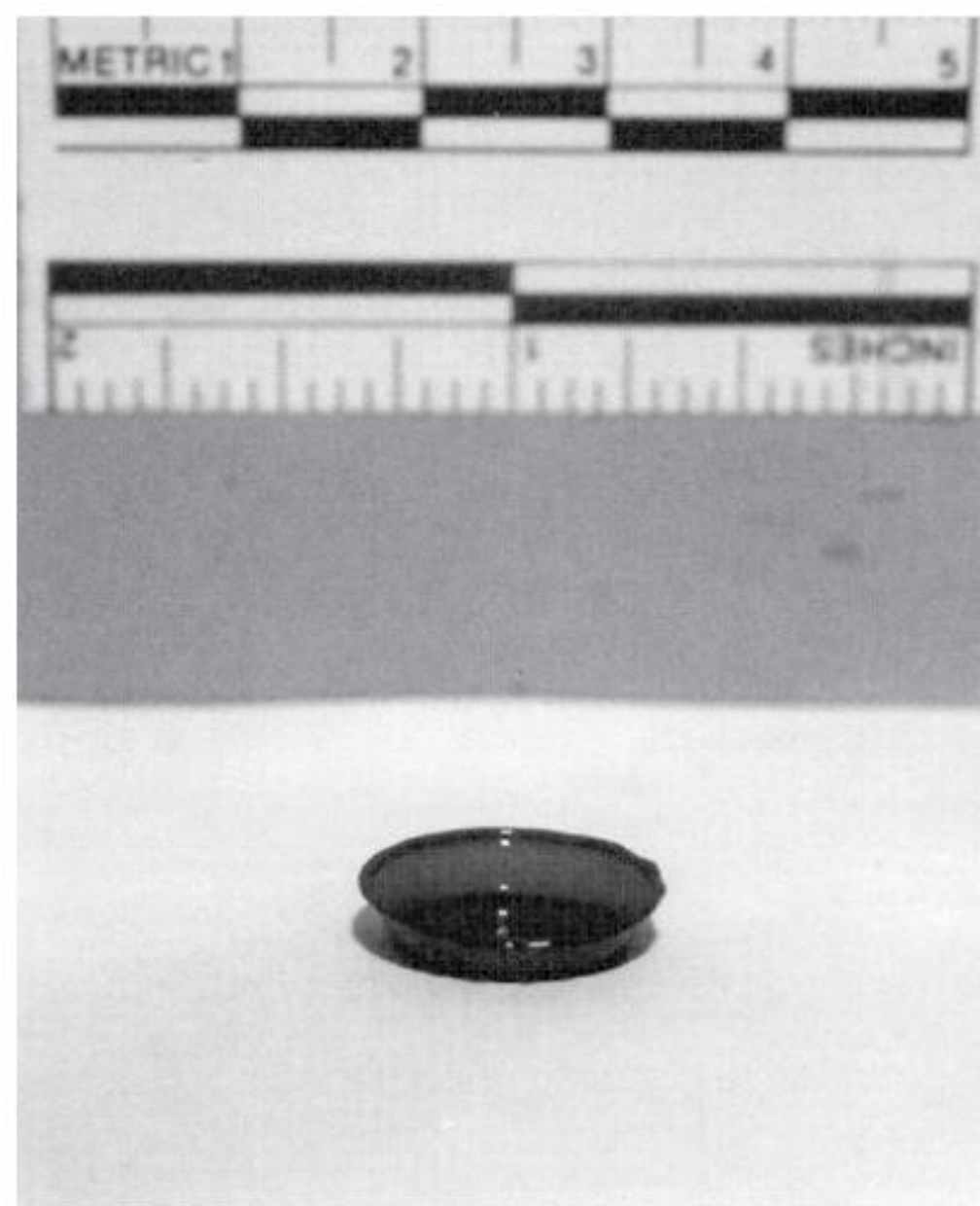


Figure 7: Early dispersion phase of a blood droplet impacting at 90°.



Figure 9: Passive bloodstains falling onto a smooth surface at approximately 90°



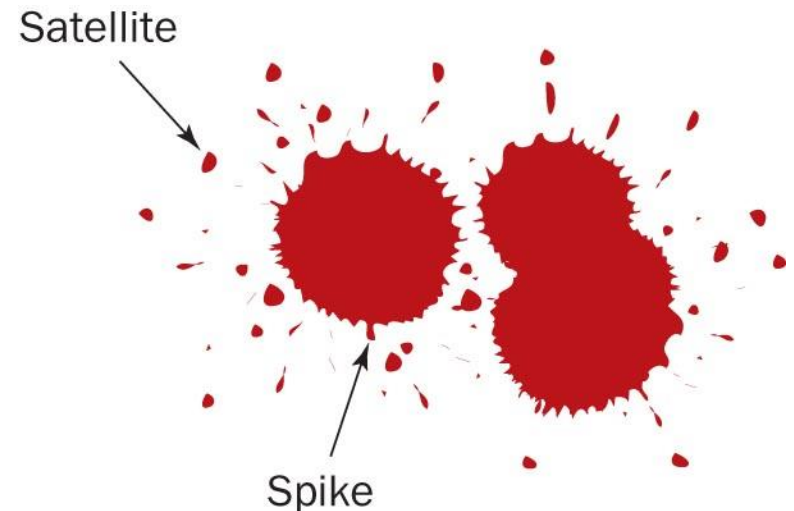
Blood Splatter Analysis

o **Satellite droplets**—

- When blood falls from a height, or at a high velocity,
- It overcomes its natural cohesiveness, and
- Separates from the main droplet

o **Spiking patterns**—

- Form around the droplet edges when blood falls onto a less-than-smooth surface





Bloodstain Terminology

- Angle of impact--angle at which blood strikes a target surface.
- Bloodstain transfer--When a bloody object comes into contact with a surface and leaves a patterned blood image on the surface.
- Backspatter--blood that is directed back toward its source of energy.
- Cast-off--blood that is thrown from an object in motion



Bloodstain Terminology

- Contact stain--general term referring to bloodstains caused by contact between a wet, blood-bearing surface and a second surface which may or may not have blood on it
 - Transfer--image is recognizable and may be identifiable with a particular object



Bloodstain Terminology

- **Swipe**--wet blood is transferred to a surface which did not first have blood on it
- **Wipe**--a non-blood bearing object moves through a wet bloodstain, altering the appearance of the original stain



Bloodstain Terminology

- o Directionality--relates to the direction a drop of blood traveled in space from its point of origin
- o Terminal velocity--the greatest speed to which a free falling drop of blood can accelerate in air. It is dependent upon the acceleration of gravity and the friction of the air against the blood--approximately 25:1 feet/second.



Bloodstain Terminology

- High velocity--greater than 100 feet per second; gives a fine mist appearance
- Low velocity--5 feet per second or less
- Medium velocity--5 to 25 feet per second.

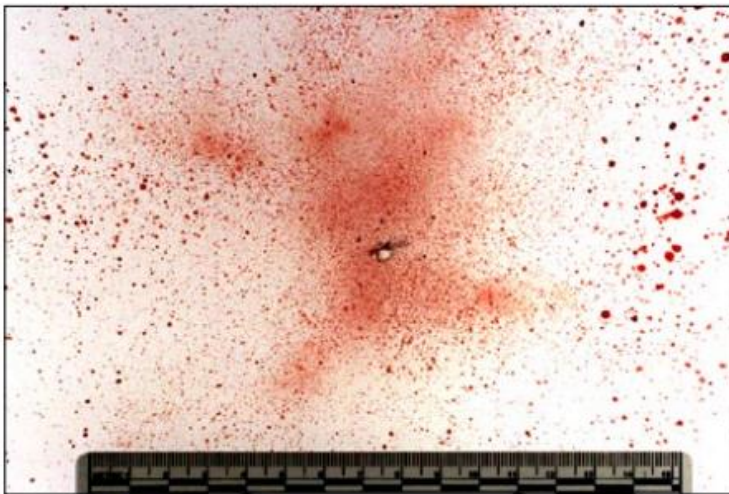


Figure 11: Spatter deposited on a wall as a result of a gunshot.



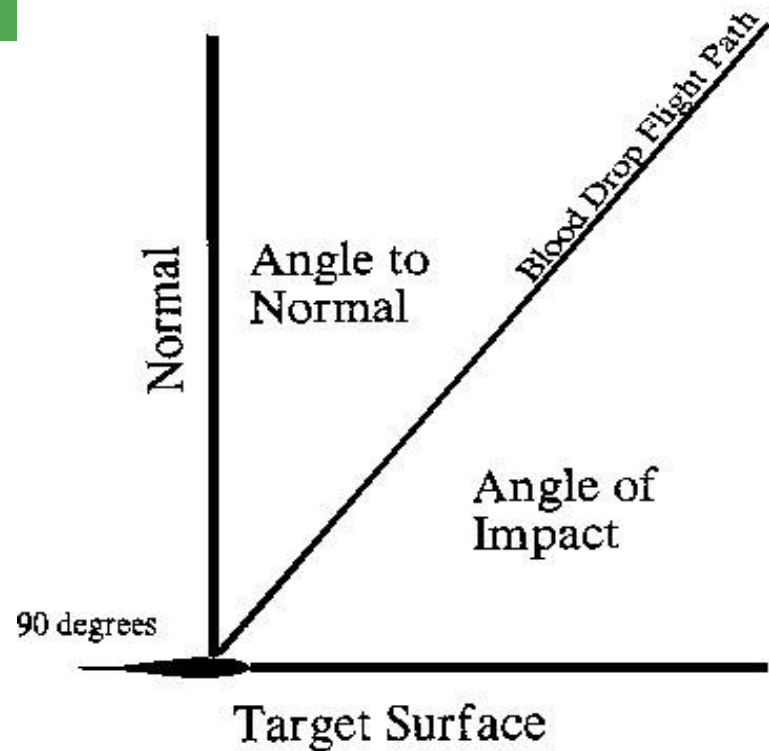
Figure 10: Spatter deposited on a wall as a result of a 'blunt force' beating.

Image courtesy UWA PhD research student Mark Reynolds.



Bloodstain Pattern

- o Terminal Velocity
- o Directionality
- o Angle of Impact





Blood Stain Patterns

The shape of a blood stain:

- | Round--if it falls straight down at a 90 degree angle.
- | Elliptical--Blood droplet elongates as the angle decreases from 90 to 0 degrees. The angle can be determined by the following formula:

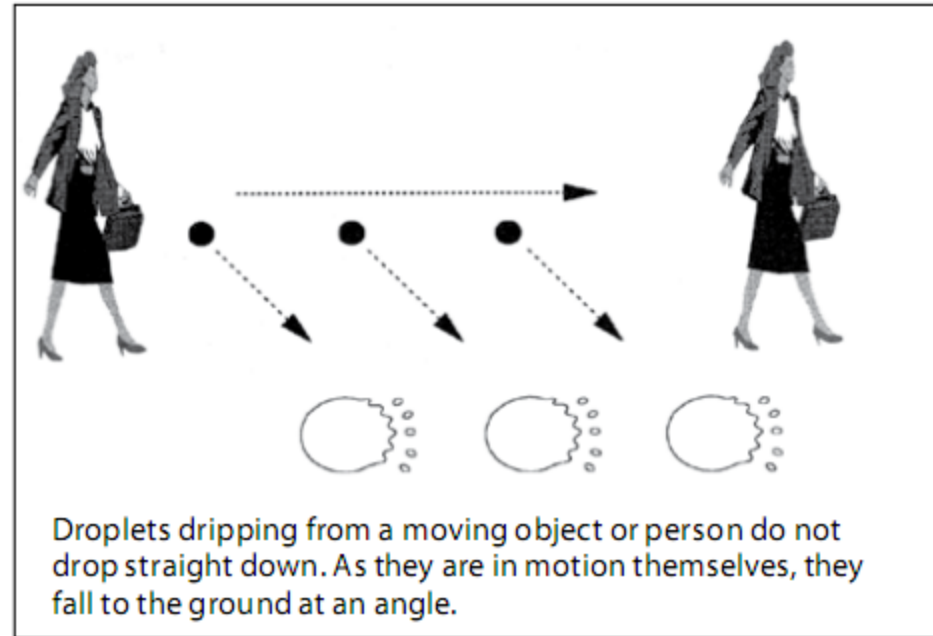
$$\frac{\text{width}}{\text{length}} = \text{sine of the impact angle}$$



IMPACT

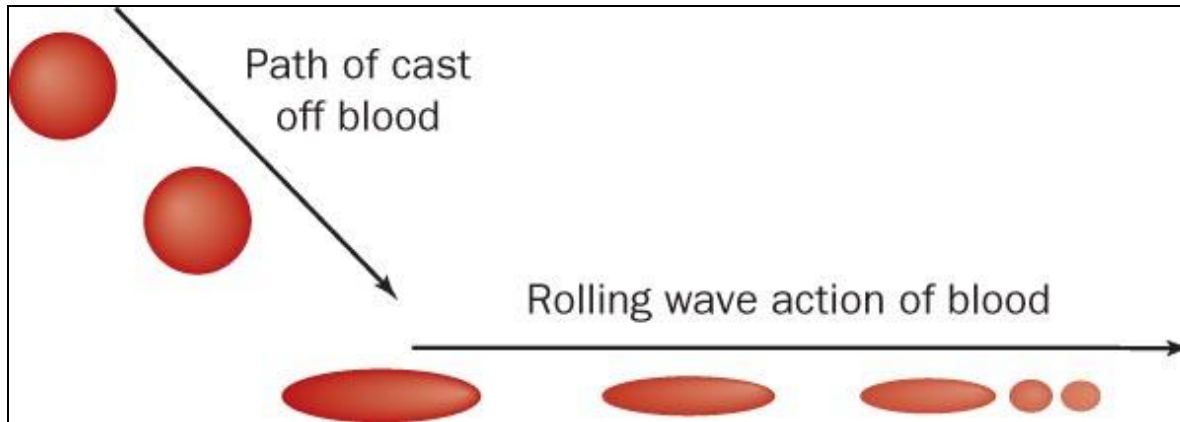
- o At about 30 degrees the stain will begin to produce a tail.
- o The more acute the angle, the easier it is to determine the direction of travel.

Identifying Blood Trail Motion



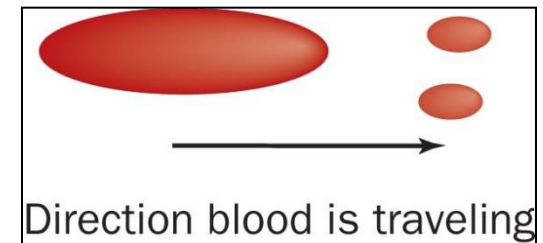


Blood Splatter Analysis —Directionality



The shape of an individual drop of blood provides clues to the direction from where the blood originated.

How will the point of impact compare with the rest of a blood pattern?



When presented with a stain, the analyst simply visualizes a line through the center of the stain, which is aligned with the spines or satellite stain.



In circular stains
the directionality is not as
distinct or clear



In elliptical stains, the directionality is
much clearer

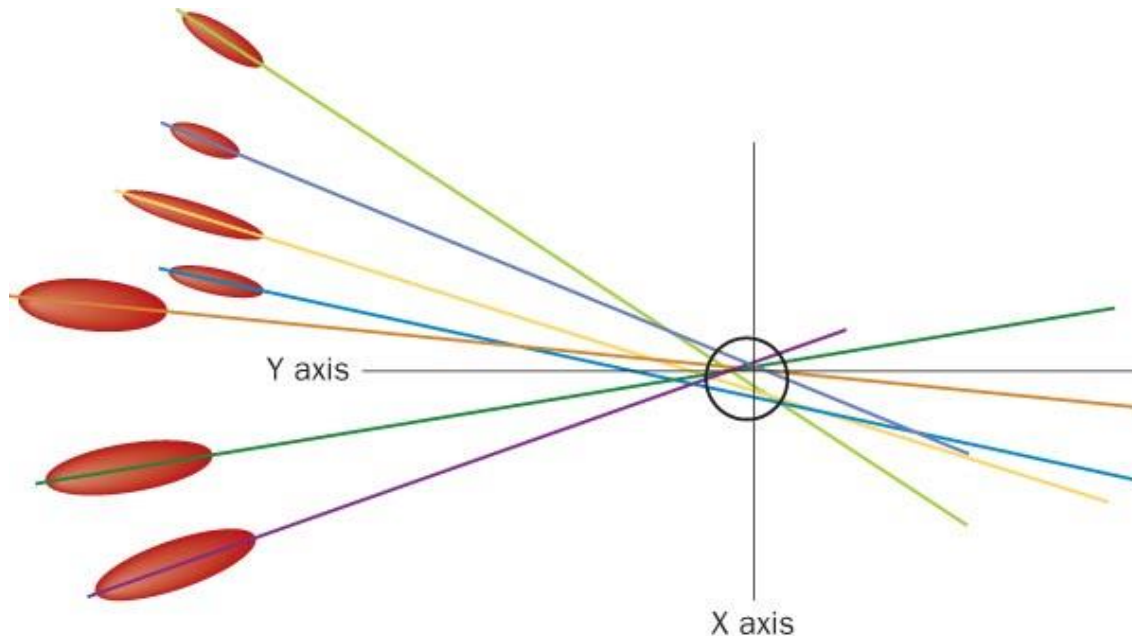
Figure 13: Scallops, spines and satellite stains are always in the direction of travel.

Image used with permission from Tom Bevel & Ross Gardner, June 2006



Blood Splatter Analysis

Lines of convergence—two or blood splatters can pinpoint the location of the blood source



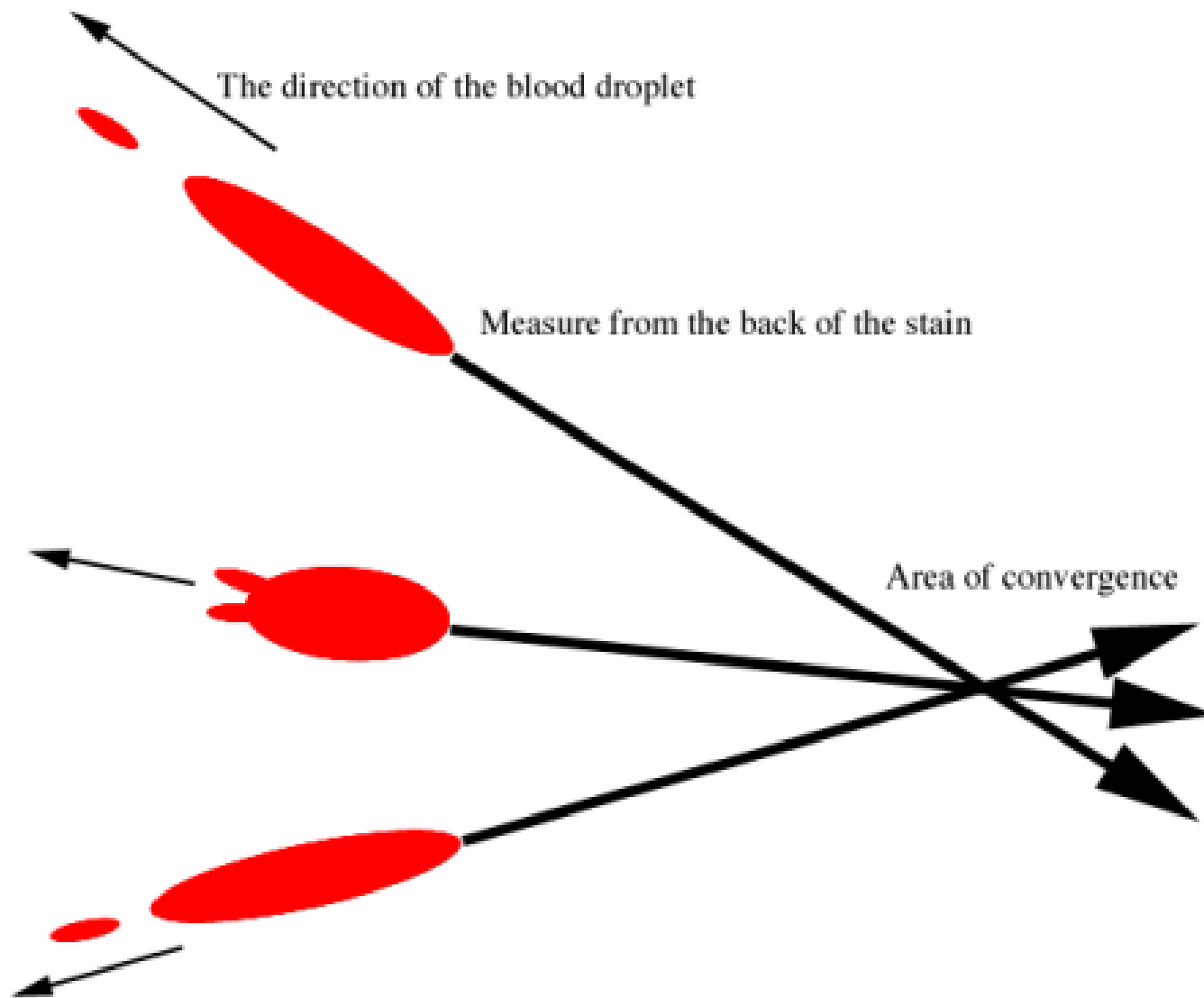


Figure 19: Measuring the distance from the bloodstain to the area of convergence.

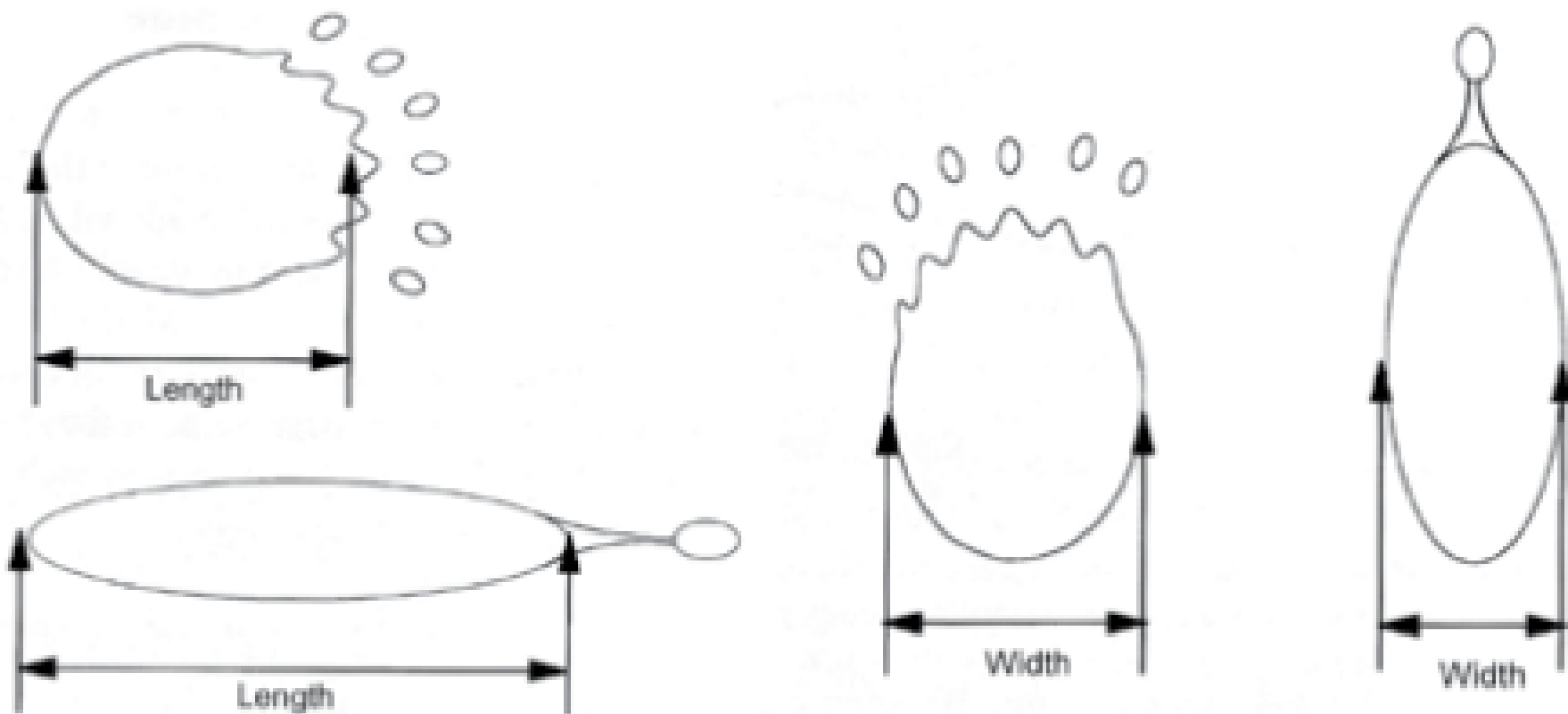
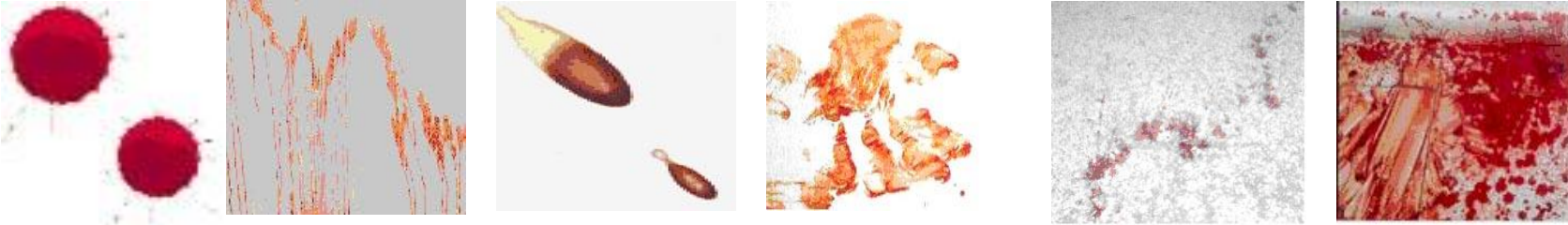


Figure 15: The measurement of the length and width of stains.

Image used with permission from Tom Bevel & Ross Gardner, June 2006



Blood Splatter Analysis —Six Patterns

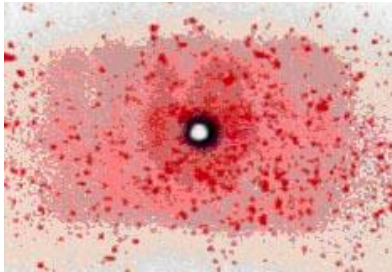


Describe each of these:

- a) Passive drops (Drip Stain)
- b) Arterial gushes
- c) Directional Droplet
- d) Transfer
- e) Drip Trail
- f) Pools



Blood Splatter Analysis —Impact



Patterns can help investigators determine the type of weapon used

- What kind of a pattern is produced by a gun shot?
- What kind of a pattern is produced by a hammer blow?



..... Summary

- Blood consists of cellular components and plasma.
- The various human blood types are caused by the presence or absence of A and/or B proteins on the surface of red blood cells.
- Blood splatter evidence can be used to recreate a crime scene.
- Investigators endeavor to (a) locate, (b) identify, and (c) interpret blood splatter patterns at crime scenes.