FORENSIC SEROLOGY
Forensics of Blood

- The criminalist must be prepared to answer the following questions when examining dried blood:
  - (1) Is it blood?
  - (2) From what species did the blood originate?
  - (3) If the blood is of human origin, how closely can it be associated to a particular individual?

- The determination of blood is best made by means of a preliminary color test.
The Tests

• A positive result from the **Kastle-Meyer color test** is highly indicative of blood.
  – Hemoglobin causes a deep pink color.

• Alternatively, the **luminol test** is used to search out trace amounts of blood located at crime scenes.
  – Produces light (luminescence) in a darkened area.

• **Microcrystalline tests**, such as the *Takayama* and *Teichmann* tests, depend on the addition of specific chemicals to the blood so that characteristic crystals will be formed.
The Tests - Continued

• Once the stain has been characterized as blood, the precipitin test will determine whether the stain is of human or animal origin.

• The precipitin test uses antisera normally derived from rabbits that have been injected with the blood of a known animal to determine the species origin of a questioned bloodstain.

• Once it has been determined that the bloodstain is of human origin, an effort must be made to associate or dissociate the stain with a particular individual.
A-B-O vs DNA

- Prior to the advent of DNA typing, bloodstains were linked to a source by A-B-O typing and the characterization of polymorphic blood enzymes and proteins.
- This approach has now been supplanted by the newer DNA technology.
- DNA analysis has allowed forensic scientists to associate blood and semen stains to a single individual.
Stain Patterns of Blood

• The location, distribution, and appearance of bloodstains and spatters may be useful for interpreting and reconstructing the events that produced the bleeding.

• Surface texture and the stain’s shape, size, and location must be considered when determining the direction, dropping distance, and angle of impact of a bloodstain.
• The crime scene investigator must remember that the location, distribution, and appearance of bloodstains and spatters may be useful for interpreting and reconstructing the events that produced the bleeding.

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Stain Patterns of Blood - Contd

- The crime scene investigator must remember that the location, distribution, and appearance of bloodstains and spatters may be useful for interpreting and reconstructing the events that produced the bleeding.
- Surface texture and the stain’s shape, size, and location must be considered when determining the direction, dropping distance, and angle of impact of a bloodstain.
Surface texture is of paramount importance. In general, the harder and less porous the surface, the less spatter results.

The direction of travel of blood striking an object may be discerned because the pointed end of a bloodstain always faces its direction of travel.

The impact angle of blood on a flat surface can be determined by measuring the degree of circular distortion. At right angles the blood drop is circular, as the angle decreases, the stain becomes elongated.

The origin of a blood spatter in a two-dimensional configuration can be established by drawing straight lines through the long axis of several individual bloodstains. The intersection or point of convergence of the lines represents the origin point.
Heredity and Paternity

- The transmission of hereditary material is accomplished by means of microscopic units called genes, located on chromosomes.
- Alternative forms of genes that influence a given characteristic (such as eye color or blood type) are known as alleles.
- Paternity testing has historically involved the A-B-O blood typing system, along with blood factors other than A-B-O.
- Currently, paternity testing has implemented DNA test procedures that can raise the odds of establishing paternity beyond 99 percent.
Testing for Seminal Stains

- Many of the cases sent to a forensic laboratory involve sexual offenses, making it necessary to examine exhibits for the presence of seminal stains.
- The best way to locate and at the same time characterize a seminal stain is to perform the acid phosphatase (an enzyme secreted into seminal fluid) color test.
  - A purple color indicates acid phosphatase enzyme.
- Semen can be unequivocally identified by either the presence of spermatozoa or of p30, a protein unique to seminal plasma.
- Forensic scientists can successfully link seminal material to an individual by DNA typing.
Rape Evidence

- The rape victim must undergo a medical examination as soon as possible after the assault.
- At that time the appropriate items of physical evidence including clothing, hairs, and vaginal and rectal swabs can be collected for subsequent laboratory examination.
- All outer and undergarments should be carefully removed and packaged separately in paper (not plastic) bags.
- Bedding, or the object upon which the assault took place, may also be carefully collected.
Rape Evidence – Contd.

• If a suspect is apprehended within 24 hours of the assault, it may be possible to detect the victim’s DNA on the male’s underwear or on a penile swab of the suspect.
• Items routinely collected from the suspect include all clothing, pubic hair, head hair, penile swab, and a blood sample or swab for DNA typing.
• The forceful physical contact between victim and assailant may result in a transfer of such physical evidence of blood, semen, saliva, hairs, and fibers.
Blood Splatter

drying blood stain

Blood Splatter
Blood Splatter

- General Blood Splatter

Slow velocity platter
Illustration of stain convergence on a two-dimensional plane. Convergence represents the point from which the stains emanated.