



# PHYSICAL EVIDENCE

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CJ 342 | USM Gulf Park

# LEARNING OBJECTIVES

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- Identify the various types of evidence
- Understand the role of trace evidence
- Recognize bloodstain pattern analysis
- Demonstrate bloodstain mechanics
- Describe how to field test for blood
- Discuss how blood evidence is packaged and handled
- Understand the role that trace evidence plays in criminal investigations
- Discuss how trace evidence is packaged and handled

# PHYSICAL EVIDENCE

- Evidence that can be handled, examined, tested, seen, felt, or tasted
- Testimonial evidence encompasses testimony of witnesses and defendants
- All physical evidence is:
  - Circumstantial evidence
  - Only partial proof of a crime

# TYPES OF EVIDENCE

- Biological evidence
- Drug evidence
- Fingerprint evidence
- Firearms evidence
- Impression evidence
- Trace evidence



# DEOXYRIBONUCLEIC ACID (DNA)

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- DNA is found in numerous types of biological evidence
  - Blood, semen, saliva, skin cells, hair, sweat, urine, vomit, feces, vaginal secretions
  - Can be used to positively identify or eliminate suspects or victims

Evidence	Possible Location of DNA Evidence	Source of DNA
Bandana, hat, mask	Anywhere (inside or outside)	Dandruff, hair, saliva, sweat
Baseball bat or similar weapon	End, handle	Blood, hair, skin, sweat, tissue
Bite mark	Clothing, skin	Saliva
Blanket, pillow, sheet The Basics	Surface area	Blood, hair, saliva, semen, sweat, urine
Bottle, can, glass	Mouthpiece, rim, sides	Saliva, sweat

# BLOOD EVIDENCE

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- The investigator may encounter blood evidence in one or more of four general areas:
  1. On the victim
  2. At the crime scene
  3. On a weapon
  4. On the assailant
- Presumptive tests for blood are initial screening tools that indicate presence of blood.
  - Used as a search method

# BLOOD EVIDENCE

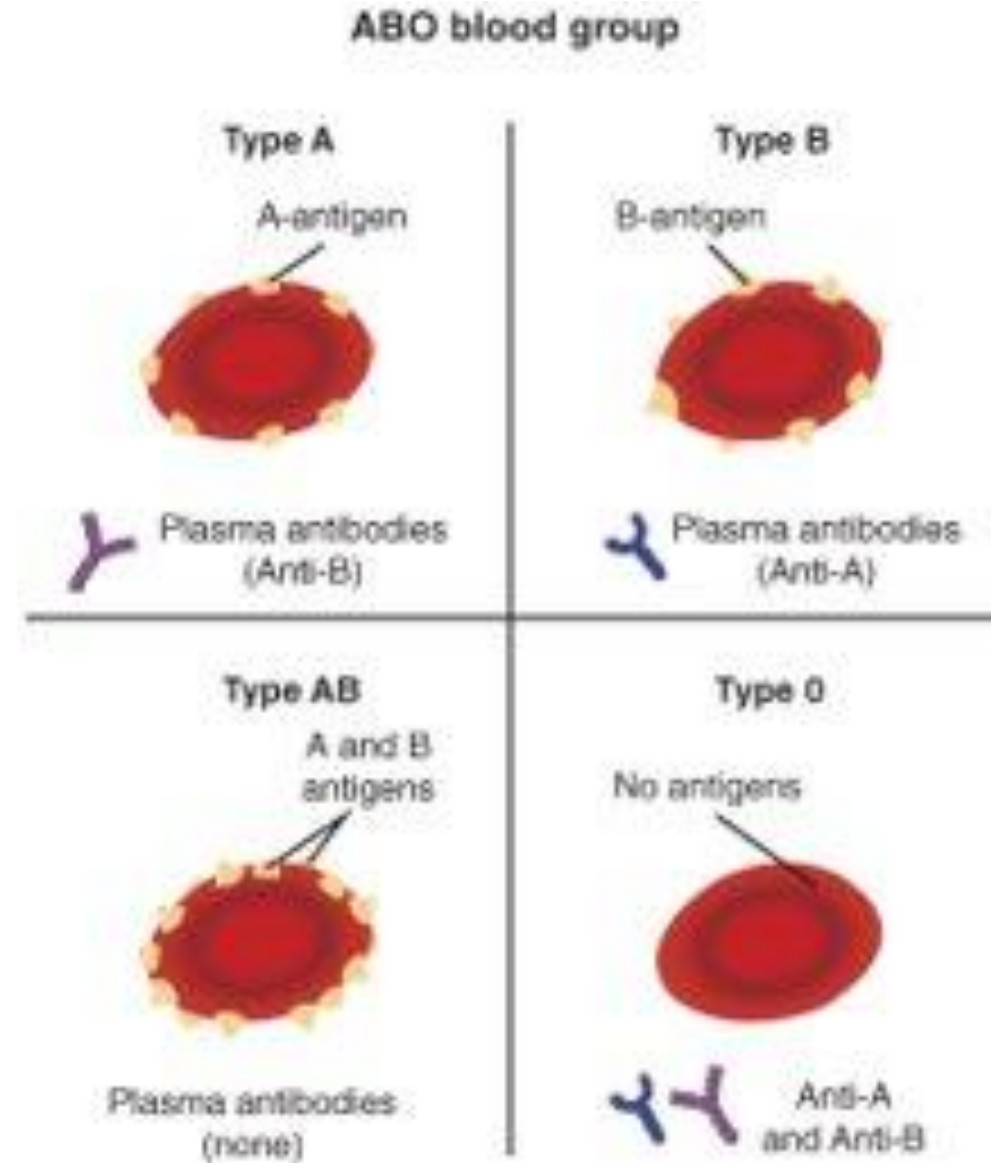




# BLOOD EVIDENCE

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- Blood typing
  - Four different categories/types: A, B, AB, and O
  - Not individualized, but is considered to be class information
  - Can assist in including or excluding individuals from consideration
  - Cannot provide specific identify





# BLOOD EVIDENCE

- Characteristics of blood types
  - Antigens: Chemical structures residing on surface of red blood cells
    - Blood types are determined by antigen on surface of these cells.
    - For every antigen, there is an antibody.
  - Agglutination: A network of linked cells
- Bloodstains as evidence:
  - Common source of evidence
  - Must be tagged and bagged
  - Must take care not to disturb patterns of blood

# BLOODSTAIN PATTERN ANALYSIS

- Bloodstain pattern analysis can provide myriad of information, including:
  - Origin of blood drops
  - Distance from origin to impact
  - Direction of the impact
  - Type of impact
  - Number of injuries
  - Position of victim/assailant at time of bloodshed
  - Movement of victim/assailant during bloodshed
  - Movement of victim/assailant after bloodshed

# HISTORY OF BLOODSTAIN PATTERN ANALYSIS

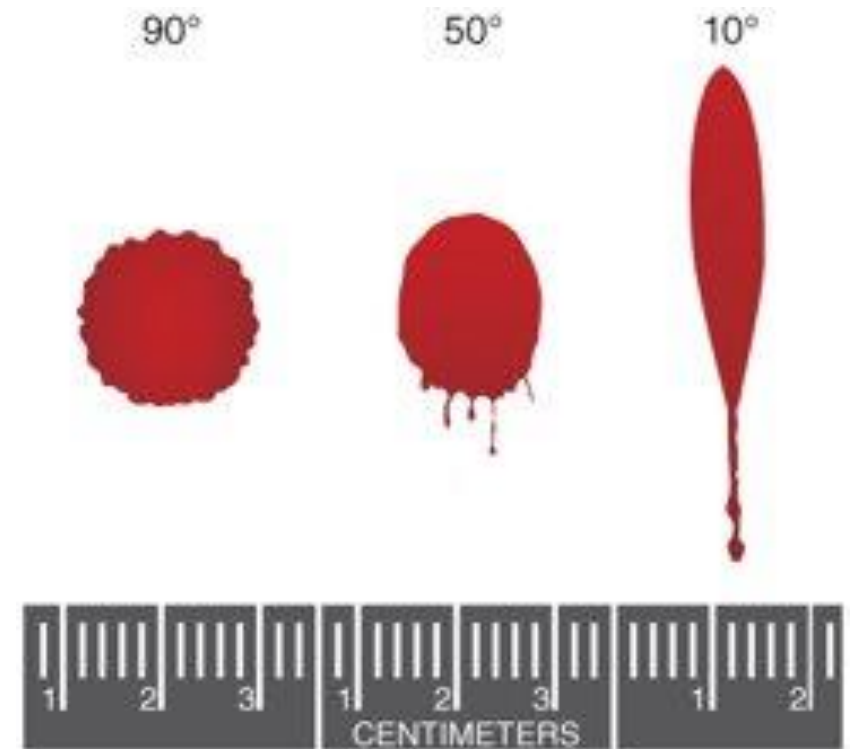
- Bloodstain pattern analysis (BSPA)
  - Dates back to the earliest of mankind's hunting efforts.
  - Biblical passages connect bloodstains with injury and mortality
  - Early 1900s saw several prominent scholars and scientists researching and experimenting with blood dynamics

# BLOODSTAIN MECHANICS

- When a drop of free-falling blood strikes a nonporous, smooth, horizontal surface, the result is a circular bloodstain.
- A rough-textured surface will cause surface tension to rupture and create a stain with spines.
- Maximum diameter is achieved when the height of the blood source allows the blood drop to reach its terminal velocity.
- For a 0.05-mL drop of free-falling blood, terminal velocity is 25 feet per second and is achieved after the blood falls a distance of about 20 feet.

# BLOODSTAIN MECHANICS

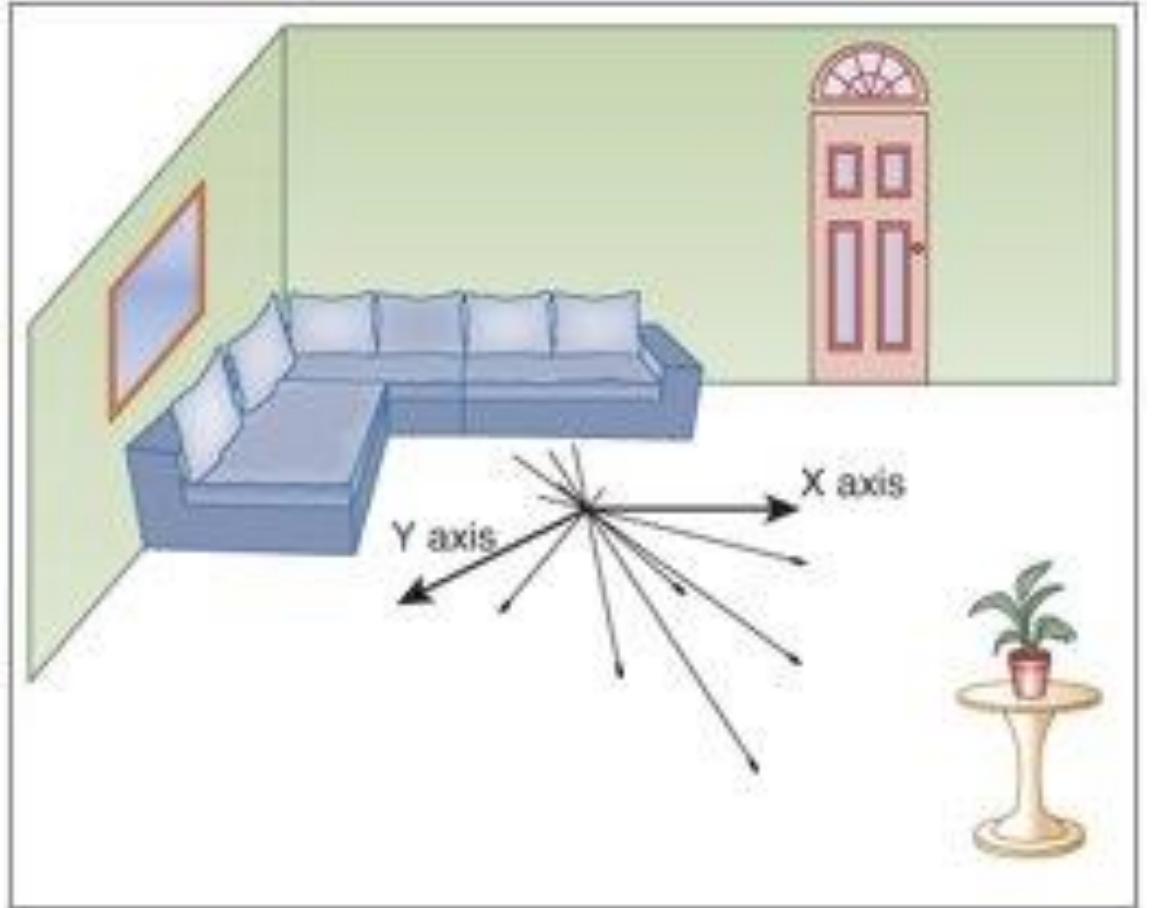
- Impact angles
  - Calculated by measuring width and length of bloodstain
  - Angle of impact calculations are usually performed with the help of computer software.



# BLOODSTAIN MECHANICS

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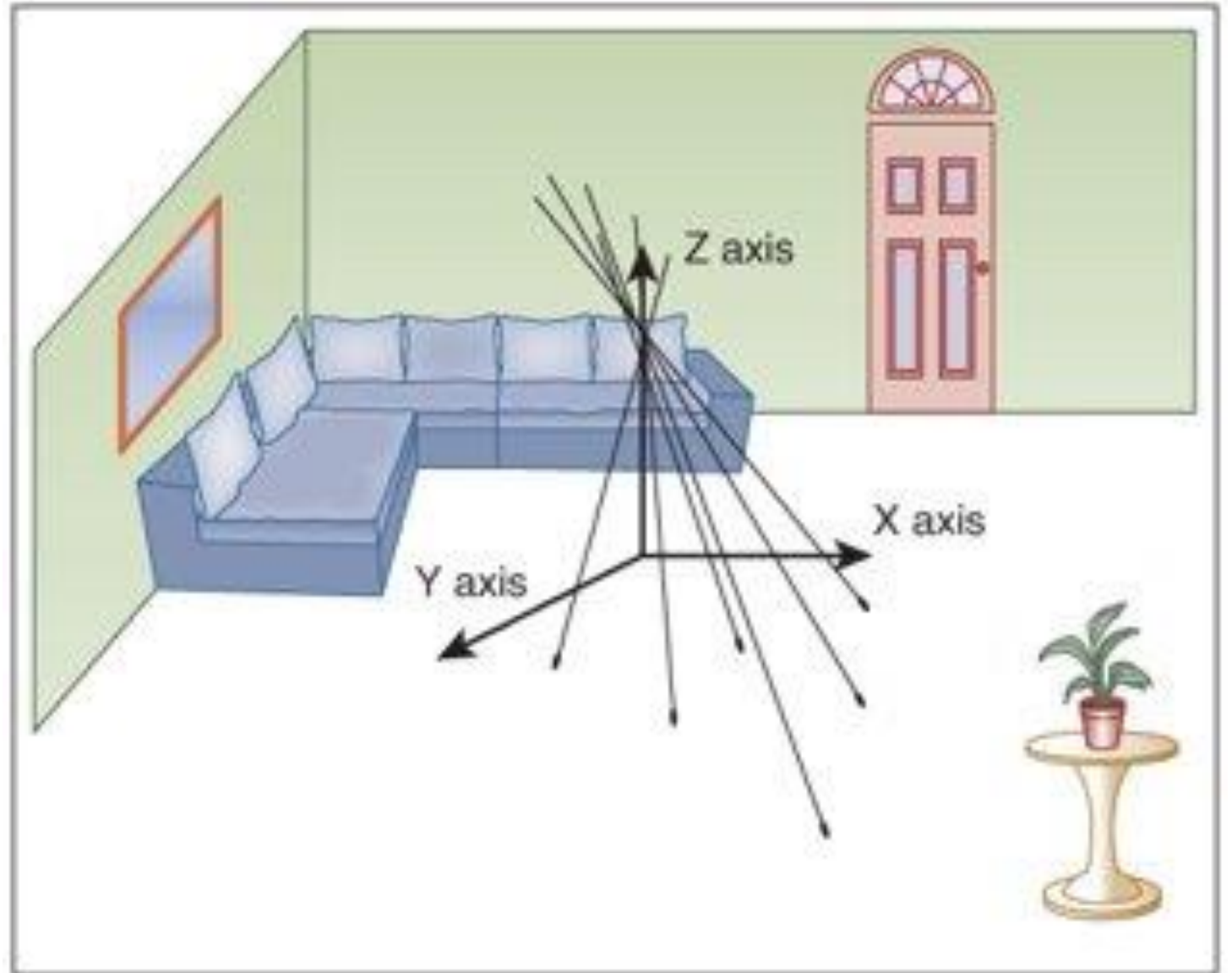
- Area of convergence
  - The area containing the intersections generated by lines drawn through the long axes of individual stains that indicate, in two dimensions, the location of the blood source



# BLOODSTAIN MECHANICS

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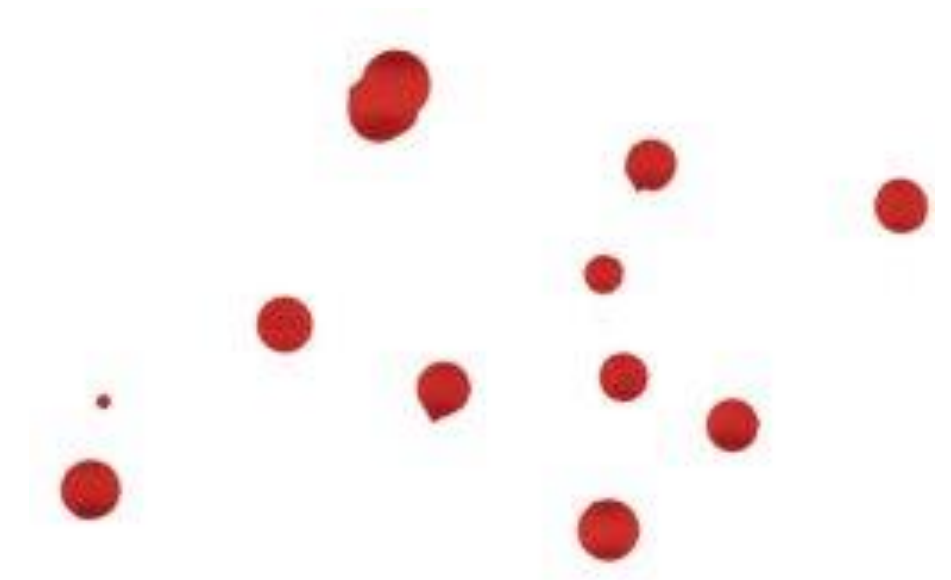
- Area of origin
  - 3D location from which spatter originated
  - Origin shows general direction blood traveled





# BLOODSTAIN MECHANICS

- Low-velocity-impact bloodstains
  - When blood drips from a stationary object or falls as a result of no other force acting upon it other than inertia
  - Ricochet: Secondary blood splashing
  - Splashed: Patterns usually have a large central area and peripheral spattering



# BLOODSTAIN MECHANICS

- Medium-velocity-impact bloodstains
  - Typically produced as a result of blunt-force trauma and stabbings
- Projected blood
  - When large quantities of blood undergo medium- or high-velocity impact
  - Arterial gushing
  - Spurting



# BLOODSTAIN MECHANICS

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- Cast-off blood
  - Repeated blows may create a pattern as blood is flung from the weapon



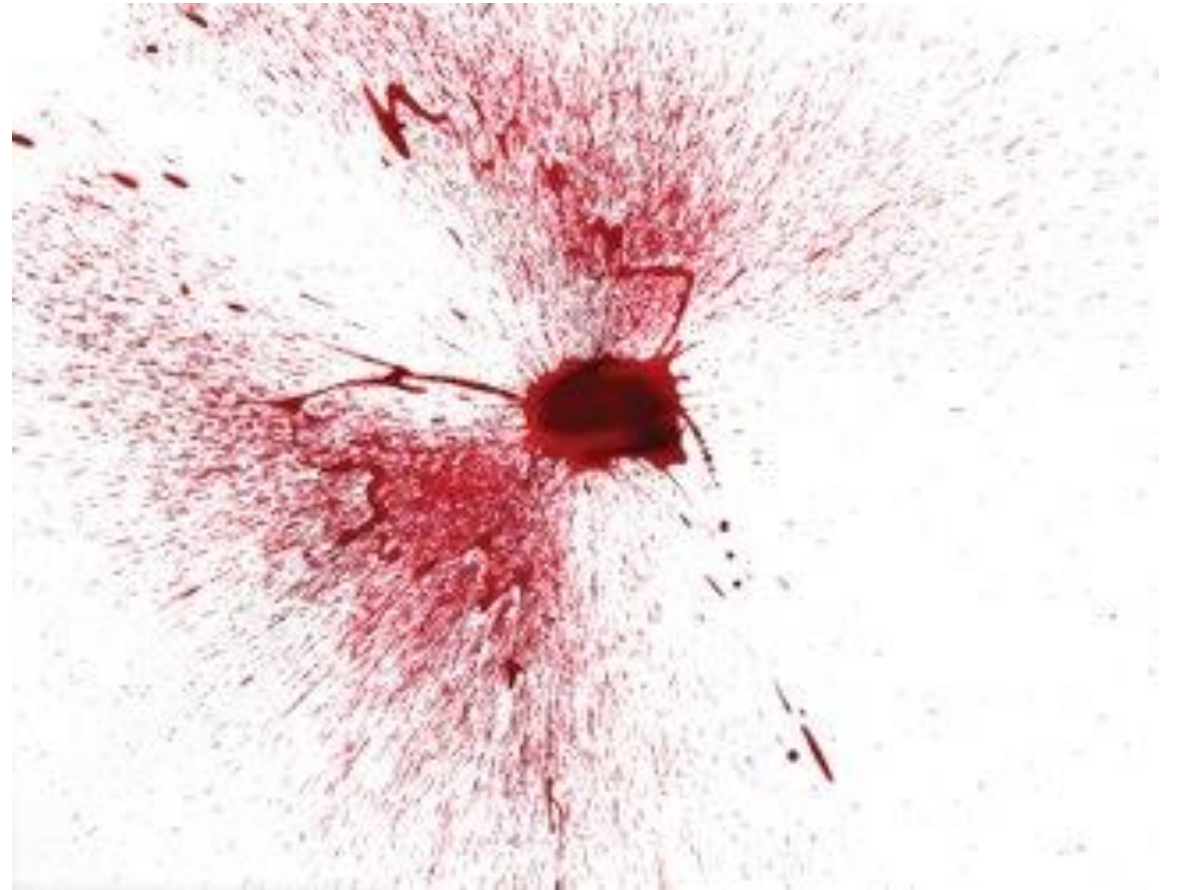
# BLOODSTAIN MECHANICS

- Flow patterns
  - Indicate direction of travel of flowing blood and may reveal victim's movement during/after bloodshed
- High-velocity-impact bloodstains
  - Collision between blood source and object moving in excess of 100 feet/second.
  - Backspatter may occur if assailant and weapon are proximate to victim upon impact

# BLOODSTAIN MECHANICS

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- Contact wounds
  - Barrel of the weapon may contain flesh, bone, and blood residue from barrel blowback or drawback
- High-velocity forward spatter
  - Product of a gunshot exit wound



# HANDLING BLOOD EVIDENCE

- Blood is often transferred from victim to assailant in violent crime scenes.
- Packaging of bloodstained clothing is critical
  - Time is of the essence.
  - Package in paper or cardboard to allow item to breathe and not degrade

# COLLECTION OF BLOOD EVIDENCE

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- Record the following:
  - Physical state (fluid, moist, dry)
  - Amount present (few drops, small pool, etc.)
  - Shape (smear, round drops)
  - Exact location in relation to fixed objects
- Pattern of stains (all in one spot, trail)
- Atmosphere conditions (temperature, humidity)
- Date and time of observation
- Scaled and unscaled photographs of stains



# COLLECTION OF BLOOD EVIDENCE

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- If wet blood is present:
  - Wear body protection while soaking up samples.
  - Soak blood onto cotton swabs.
  - Continue collecting stain until it is completely collected or five swabs have been saturated.
- Make sure to avoid contamination of swabs.
- Consider changing gloves frequently.
- Allow swabs to dry in place.
- Package the dried swabs in a paper container.
- Properly label and seal each container.
- Collect sample from unstained area.

# DRIED OR MOIST BLOODSTAIN RECOVERY

- If stained object is transportable, submit it intact.
- If suspected blood is still moist, allow it to thoroughly air dry.
- Label area with "biohazard" signs.
- Package item in a clean paper container, seal, and label.

# HANDLING GUIDELINES

- All bloodstained material be submitted for testing without delay.
- Investigators should devise a delivery protocol.
- All containers in which blood is placed should be saved and available at the time of trial.

# OTHER BIOLOGICAL FLUIDS & EVIDENCE

- Semen
- Saliva
- Hair
- Urine
- Vomitus
- Vaginal secretions

# PRESERVATION OF DRIED BIOLOGICAL EVIDENCE

- Ideal way to preserve biological evidence is to freeze it.
- Large fluctuations in temperature should be avoided.
- Packet needs to be frozen.
  - If this packet is included with evidence it will be labeled "biological evidence enclosed, please remove and freeze."

# TRACE EVIDENCE

- Evidence small in size that would require microscopic analysis
  - Hairs
  - Fibers
  - Paint
  - Glass
  - Soil

# PROBABILITY/PRODUCT RULE

- Probability
  - Frequency with which an event will occur
  - Sometimes referred to as the odds of occurrence
- Product rule
  - When frequencies of independently occurring variables are multiplied together to obtain an overall frequency of occurrence



# UTILIZING THE PRODUCT RULE

**TABLE 5.1** Utilizing the Product Rule

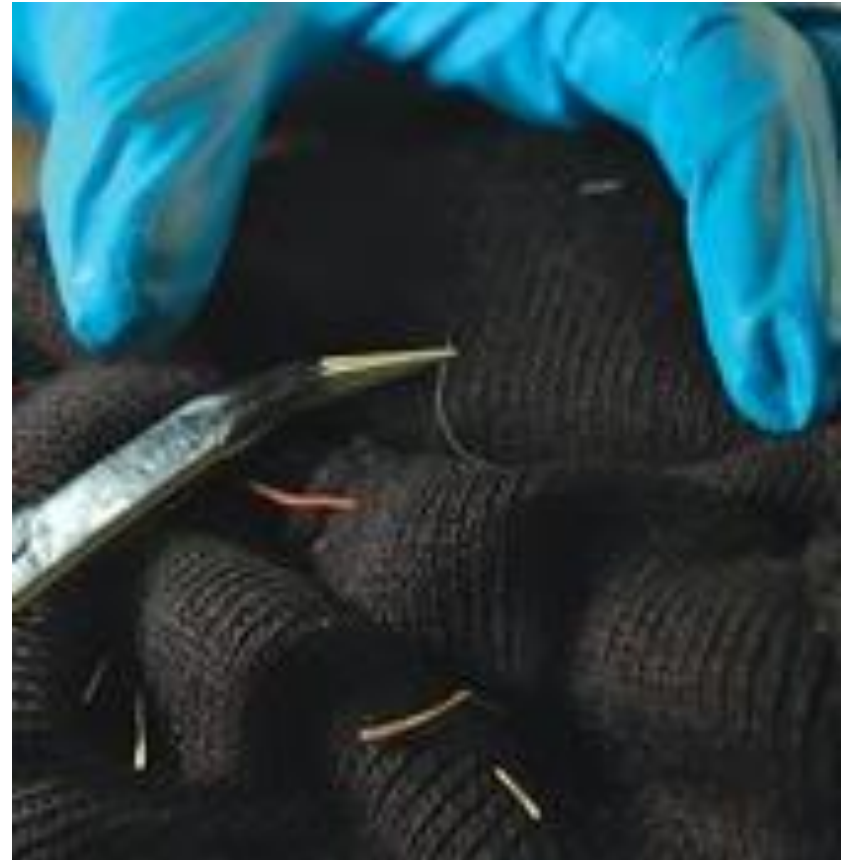
Demographic	Statistic	Percentage	Equation
Number of people in the United States (est.)	295,734,134		
Population that is white	241,614,787	81.70%	$(241,624,787 \div 295,734,134)$
Population that is white male	118,705,344	49.13%	$(118,705,344 \div 241,614,787)$
Population of white males over age 30	42,401,549	35.72%	$(42,401,549 \div 118,705,344)$

Using the product rule,  $0.817 \times 0.4913 \times 0.3572 = 0.1433$ , or 14.33%, or 1 in 7 persons could have been involved in the commission of the crime. Data from the Central Intelligence Agency. (2006). The World Factbook. Retrieved August 4, 2009, from <https://www.cia.gov/library/publications/resources/the-world-factbook/index.html>.

# COLLECTION OF TRACE EVIDENCE

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- Entire item containing suspected evidence should be collected and preserved for later analysis
  - If conditions do not allow for this, on-scene steps must be taken to properly collect and preserve trace evidence.

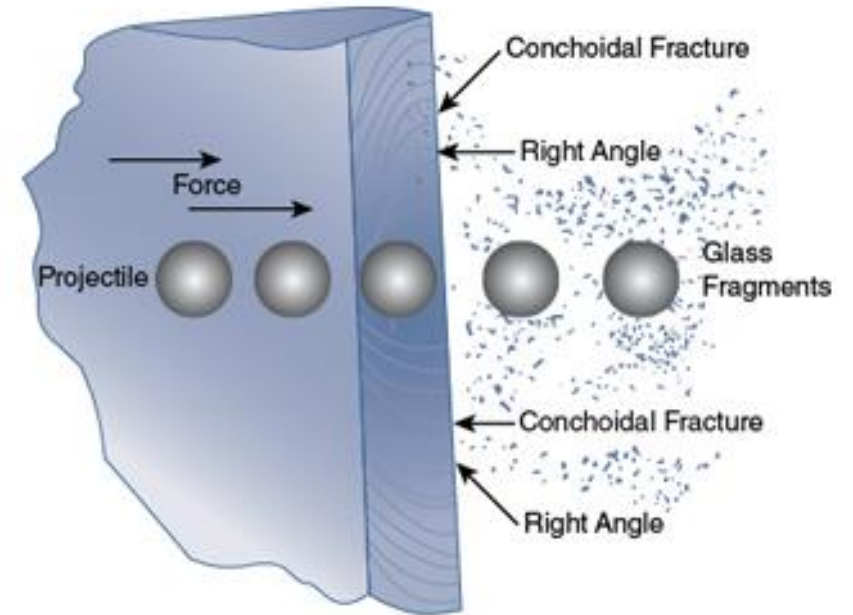


# COLLECTION OF TRACE EVIDENCE

- Important considerations to keep in mind:
  - Elimination hair/fiber samples may need to be obtained
  - Prioritize order of evidence collection.
  - Once trace evidence is collected, remove bullets, dust for fingerprints, and so on.
  - Do not process for fingerprints prior to trace evidence collection.
    - Can transfer trace evidence onto clothing of technicians and/or contaminate trace evidence with dusting powder

# GLASS EVIDENCE

- Frequently encountered as transfer evidence
- Fracture analysis
  - Can be useful in determining whether a window was broken from the inside or outside
    - Radial fractures
    - Concentric fractures
    - Conchoidal fractures



# COLLECTING & PACKAGING GLASS EVIDENCE

- Must be thorough if forensic lab is to have a chance to attempt analysis
- Typically viewed as class evidence
  - Only rarely able to be individualized
- Approximately one square inch of material is all that will be required for forensic analysis
- Fragment(s) should be packaged in solid containers
- Should be wrapped individually in paper
  - Ensures trace evidence is not lost in transport
- Packaged in a porous material

# PAINT EVIDENCE

- Includes paint chips and fragments of other protective coatings, such as:
  - Varnishes
  - Sealers
  - Lacquers
  - Enamels
  - Plastics

# PAINT EVIDENCE ANALYSIS

- International Forensic Automotive Paint Data Query (PDQ)
  - World's largest international, searchable database
  - Used by forensic laboratories
  - Paint samples are collected from vehicles at body shops, junkyards, and automobile manufacturers



# SOIL EVIDENCE

- Any disintegrated surface material, natural or man-made, that lies on or near the earth's surface
- Forensic analysis of soil
  - Relates to naturally occurring components
  - Includes identification and examination of man-made components

# COLLECTING & PACKAGING SOIL EVIDENCE

- Soil variation is fundamental consideration in soil analysis.
  - Establishing variation must be considered.
- Standard/reference samples of soils are collected at various intervals within a 100-yard radius.
- Samples should be dried and then packaged.

# HAIR & FIBER EVIDENCE

- Hair and fibers are frequently found as evidence.
  - Cross-transfer of hair and/or fibers between a victim and an assailant can provide supportive evidence.
  - DNA analyses may be performed on root.

# COLLECTION OF HAIR & FIBER STANDARDS

- Necessary to obtain standard hair and fiber samples from all possible sources for comparison with questioned hairs and fibers
  - DNA analysis on hair roots replaced microscopic hair comparisons

# FIBER EVIDENCE

- Considered a form of trace evidence
- Can be transferred from clothing of a suspect to clothing of a victim
  - Primary transfer: Fiber is transferred from fabric directly onto a victim's clothing
  - Secondary transfer: Already transferred fibers on clothing of a suspect transfer to clothing of a victim

# COLLECTING & PACKAGING FIBER EVIDENCE

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- Similar to methodology for collection of hair evidence
- Reference and elimination samples must be collected, properly documented, and packaged.

