Best Practices for Bloodstain Pattern Analysis in Cold Cases of Sexual Assault and Homicide

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The portions of this presentation prepared by Jennifer Dillon were done so in her own capacity. The views and opinions expressed in this lecture are the presenter's own and do not reflect the view of her employer, the Michigan Department of State Police. Contact information related to said employer does not indicate collaboration with the agency in this effort.

Jennifer Dillon

Jennifer Dillon is a forensic scientist with the Michigan State Police and has casework experience in multiple disciplines including Body Fluid Identification, DNA, Trace Evidence, Footwear/Tire Track, Bloodstain Pattern Analysis, and Crime Scene Response. She has a passion for continuing education to include being of service to the criminal justice community through teaching on topics such as: DNA, cold case investigations, trace evidence, evidence collection/preservation, crime scene management, and bloodstain pattern recognition/documentation.

Jennifer also advocates the use of mindfulness-based stress reduction techniques to mitigate common stressors experienced in the field of forensic science and law enforcement/first responders. She strives to cultivate a shift in culture to build resiliency and sustainability within the workplace by providing educational content for the Mental Agility development series for the Midwestern Association of Forensic Scientists. This program provides resources to strengthen mental fitness including the "Mental Agility for Forensic Scientists" podcast, which Jennifer hosts.

John Wilkinson

John F. Wilkinson, an Attorney Advisor with AEquitas, presents on trial strategy, legal analysis and policy, and ethical issues related to violence against women at the local, state, national and international level. He conducts research; develops training materials, resources, and publications; and provides case consultation and technical assistance for prosecutors and allied professionals. John served as an Assistant Commonwealth's Attorney in Fredericksburg, VA prosecuting cases involving intimate partner violence and sexual assault, including cases of campus sexual assaults and domestic violence homicide. He also served on the Fredericksburg Area Sexual Assault Response Team and prosecuted child sexual and physical abuse and neglect cases and infant homicides.

Objectives

- Explain the foundational basis of the science of Bloodstain Pattern Analysis.

- Explain the history and current best practices of bloodstain pattern documentation and analysis.

- Assess if documentation in your case is adequate to request bloodstain pattern analysis in a cold case.

- Prepare for testimony, to include discovery requests and pre-trial conferences.

- Educate judges and juries about the significance of bloodstain pattern analysis.

- Anticipate and respond to defense challenges at trial.

Bloodstain Pattern Analysis

Foundation of the Science

Bloodstain Pattern Analysis

- Examination of the size, shape, distribution, and location of bloodstains in attempt to establish the physical events that gave rise to their origin.

- Because blood is a fluid that adheres to physical laws, patterns are predictable and be reproducible under similar conditions.

Types of Bloodstain Patterns

- Transfer Stains – result of contact between a blood bearing surface and another surface.

- Spatter stains – result of blood drop being dispersed through the air as a result of an external force being applied to liquid blood source.
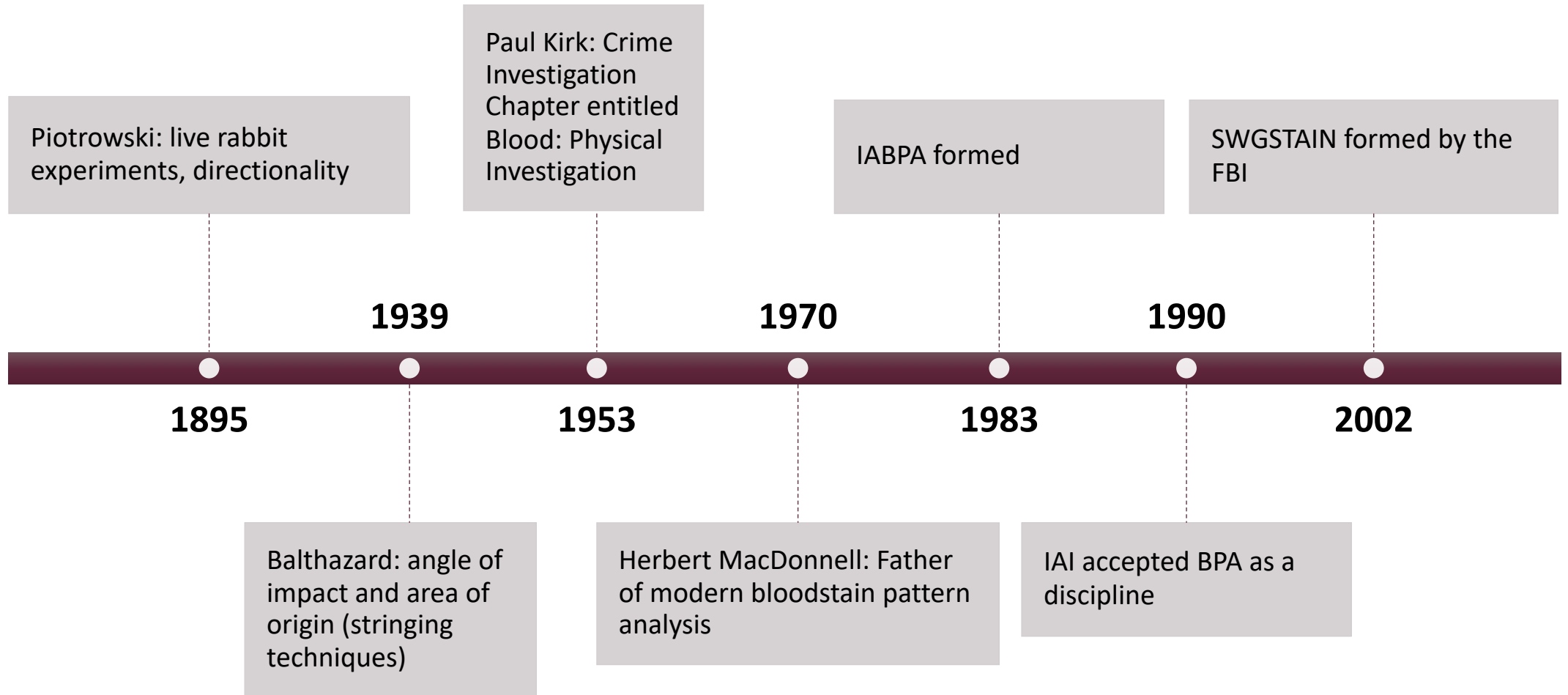
What can we learn from a bloodstain pattern?

- Approximate position of a victim at the time of bloodshed.
- Approximate position of other subjects.
- The area of origin of the bloodstains.
- The sequence of events that created the patterns.
- Movement of objects or people at the scene during or after bloodshed.
- Agreement/disagreement of the appearance of bloodstains compared to statements provided by subject.
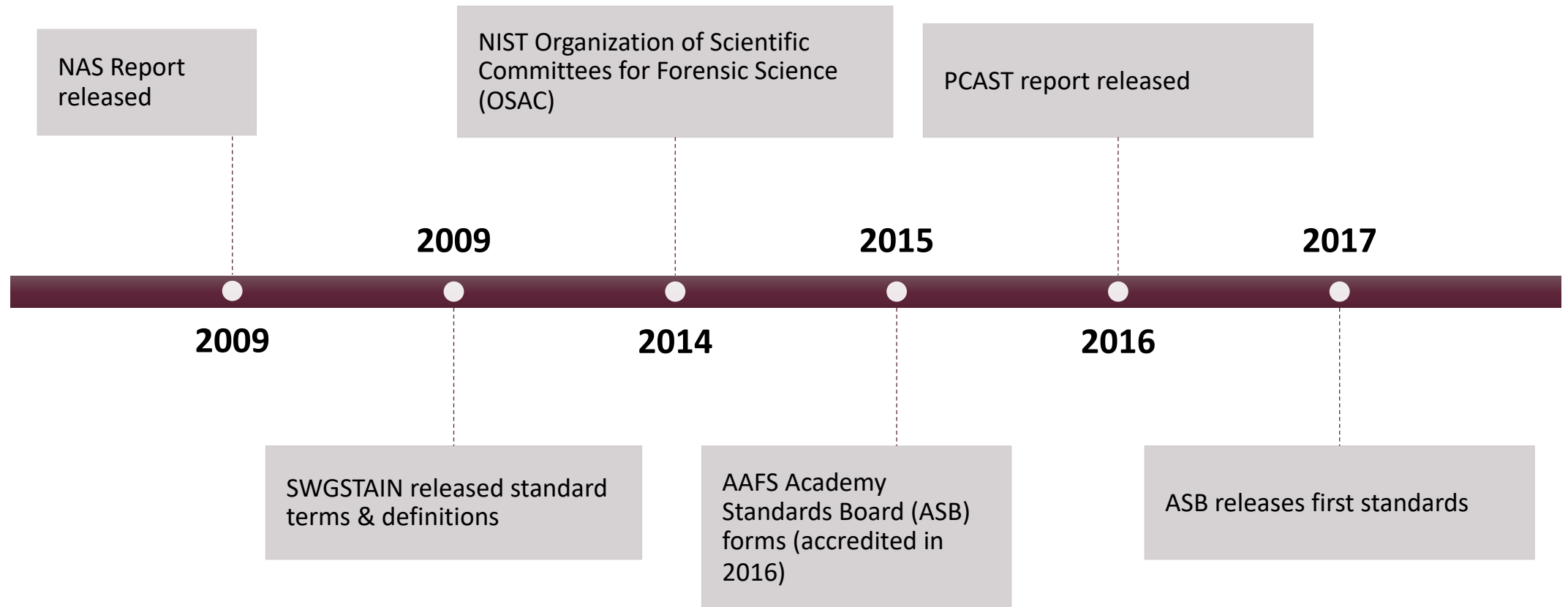
Remember…

- We are looking at the static result of blood droplets moving through air and creating a bloodstain or bloodstain pattern.

- The interpretation of these patterns can assist in determining the mechanism of deposition (how the patterns were developed).

- The amount of information we see in the resulting pattern will determine our ability to make this determination. It is possible to perform bloodstain pattern analysis from evidence and photographs alone, but we must have adequate documentation.

Early History

Piotrowski: live rabbit experiments, directionality

Paul Kirk: Crime Investigation Chapter entitled Blood: Physical Investigation

IABPA formed

SWGSTAIN formed by the FBI

1939

1970

1990

1895

1953

1983

2002

Balthazard: angle of impact and area of origin (stringing techniques)

Herbert MacDonnell: Father of modern bloodstain pattern analysis

IAI accepted BPA as a discipline

2009 & Beyond

2009

2015

2017

2009

2014

2016

NAS Report released

NIST Organization of Scientific Committees for Forensic Science (OSAC)

PCAST report released

SWGSTAIN released standard terms & definitions

AAFS Academy Standards Board (ASB) forms (accredited in 2016)

ASB releases first standards

Published Standards & Guidelines

- 2017 – Terms and Definitions in Bloodstain Pattern Analysis
- 2019 – Standard for the Validation of Procedures in Bloodstain Pattern Analysis
- 2019 – Standard for a Quality Assurance Program in Bloodstain Pattern Analysis
- 2020 – Standards for a Bloodstain Pattern Analyst's Training Program
- 2020 – Standard for Report Writing in Bloodstain Pattern Analysis

Documentation vs Analysis

- Documentation of bloodstain patterns can be done by an evidence technician with minimally advanced training above the basics.

- The classification and interpretation of these patterns must be done by a trained professional who has had their work peer reviewed.

Bloodstain Pattern Analyst

- In-house training course with competency test & written exam
- 40-hour basic course
- 36-hour advanced course
- Fluid Dynamics of Bloodstain Pattern Formation
- Proficiency tested
- May work in accredited lab, discipline may be accredited
- Continuing education
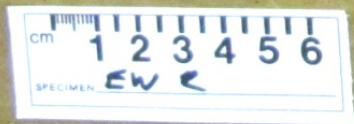- Membership in a professional organization related to BPA

Drip Stain

- A bloodstain resulting from a falling drop that formed due to gravity.

- Drip Trail – a bloodstain pattern resulting from the movement of a source of drip stains between two points.

WARNING: The following images are graphic in nature and depict bloodstain patterns created during training exercises.
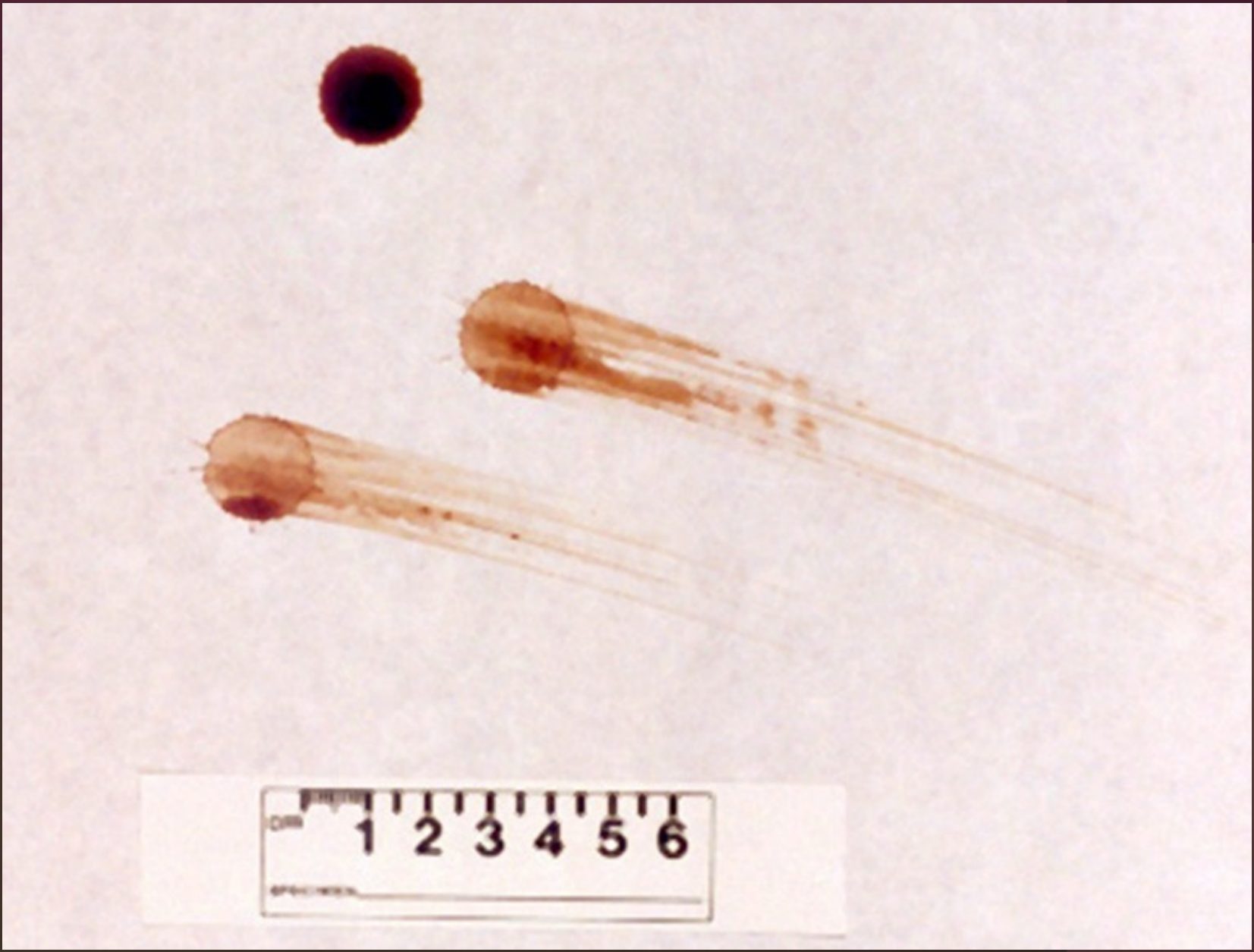
Transfer Stain

- A bloodstain resulting from contact between a blood-bearing surface and another surface.
  - A recognizable image of all, or a portion of all, of the original surface may be observed in the pattern (footwear impression, hand).

- Swipe Pattern
  - A bloodstain resulting from the transfer of blood from a blood-bearing surface onto another surface, with characteristics that indicate relative motion between the two surfaces.
- Wipe Pattern
  - An altered bloodstain resulting from an object moving through a preexisting wet bloodstain.
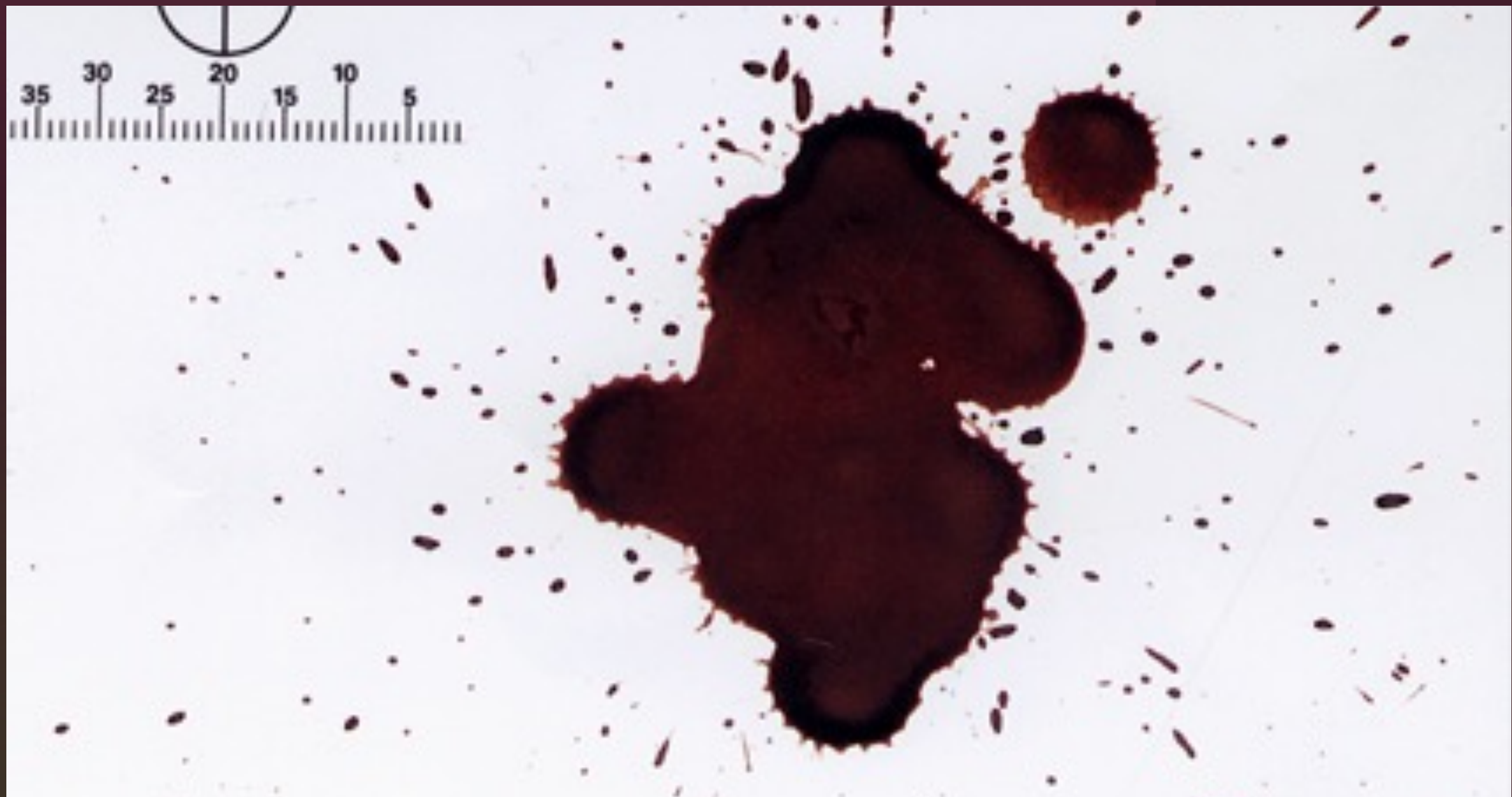
Projected Pattern

A bloodstain pattern resulting from the ejection of blood under hydraulic pressure, typically from a breach in the circulatory system.

Drip Pattern

A bloodstain pattern resulting from a liquid that dripped into another liquid, at least one of which was blood.

Impact Pattern

- A bloodstain pattern resulting from an object striking liquid blood.

- The amount of spatter from an impact varies considerably depending upon many circumstances, such as the victim's hair, clothing, weapon and positioning.

Cast-off Pattern

A bloodstain pattern resulting from blood drops released from an object due to its motion.
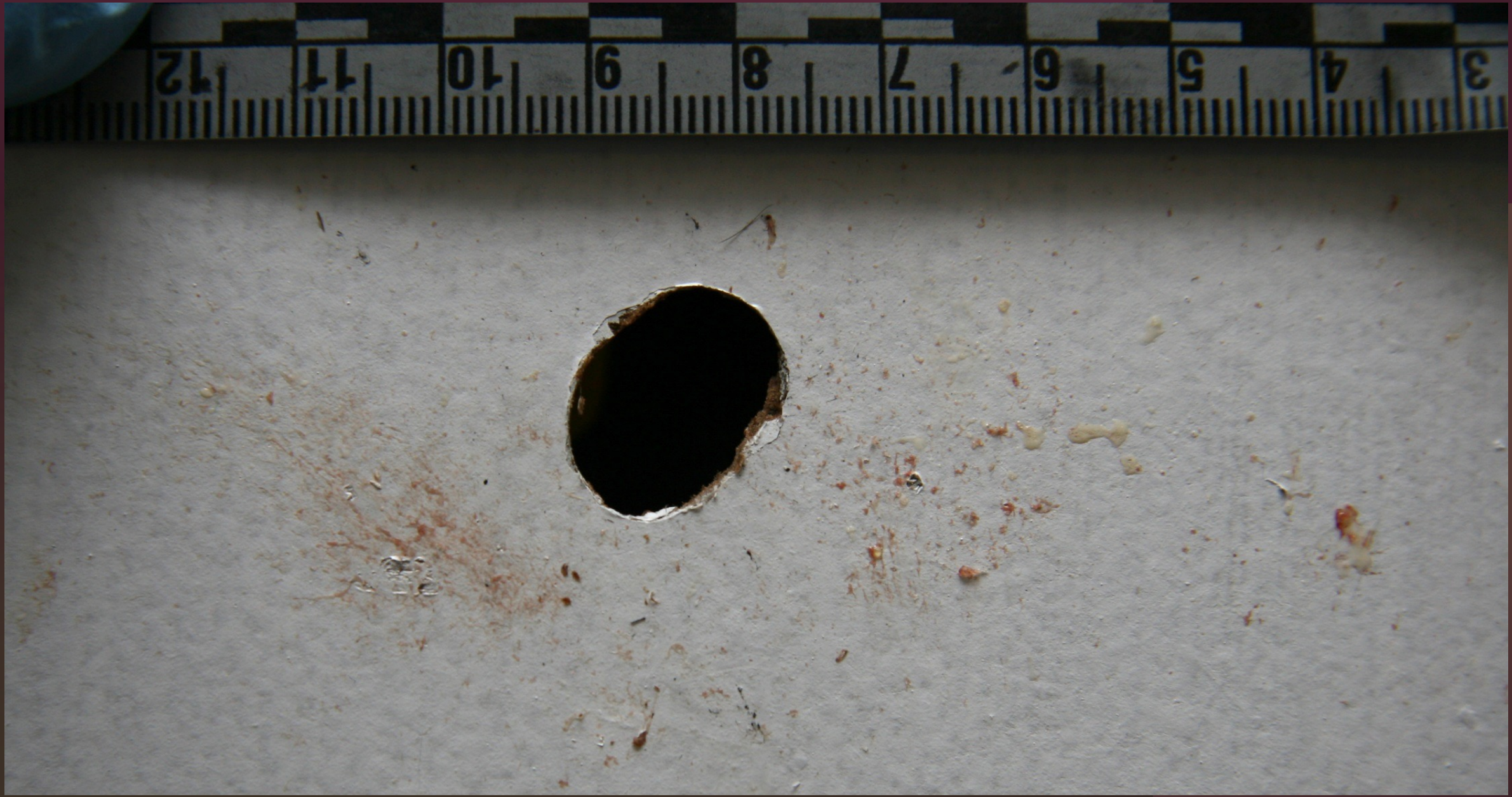
Expiration Pattern

A bloodstain pattern resulting from blood forced by airflow out of the nose, mouth, or a wound.

Forward Spatter Pattern

A bloodstain pattern resulting from blood drops which can be produced when a projectile creates an exit wound.

Backspatter Pattern

A bloodstain pattern resulting from blood drops which can be produced when a projectile creates an entrance wound.
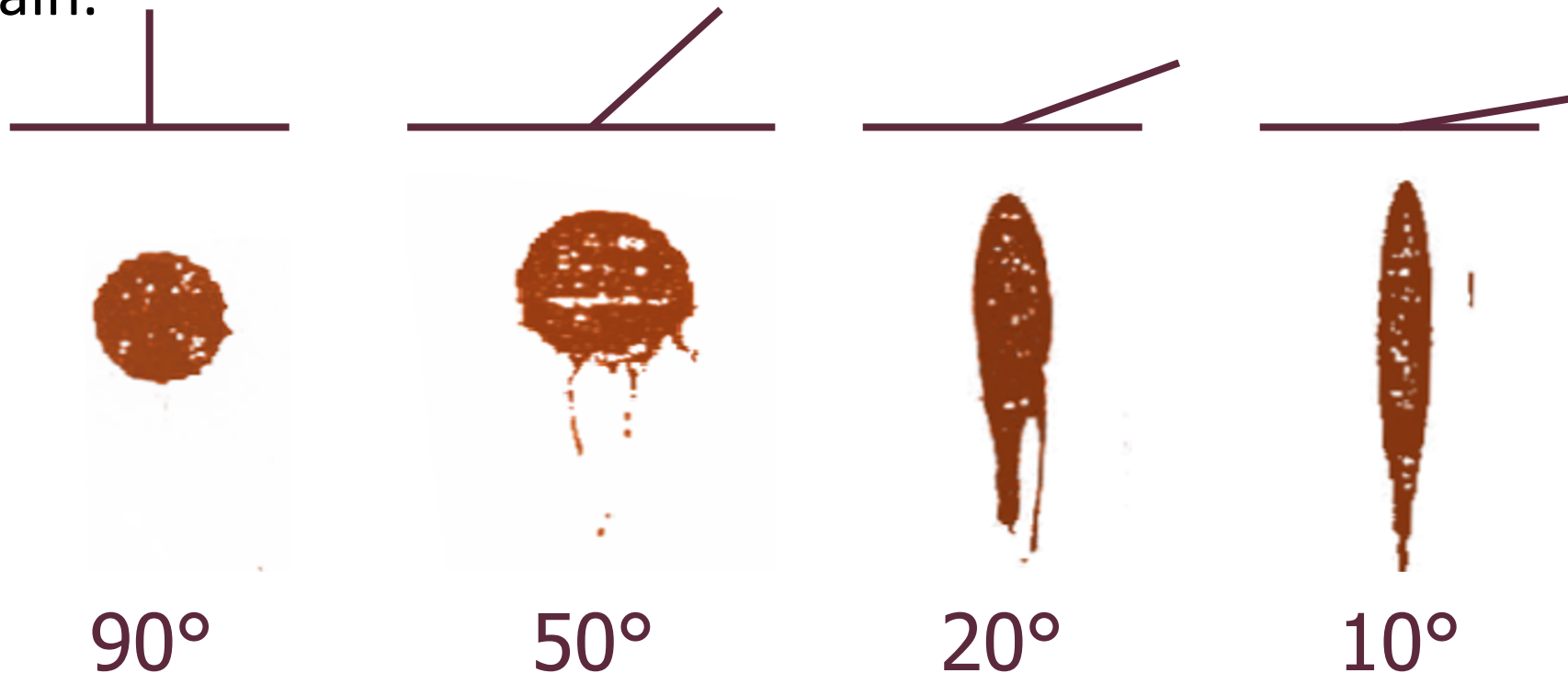
Directionality

- The characteristic of a bloodstain that indicates the direction blood was moving at the time of deposition.

- The tail of the bloodstain indicates the forward direction of travel prior to impact.

Direction of Travel
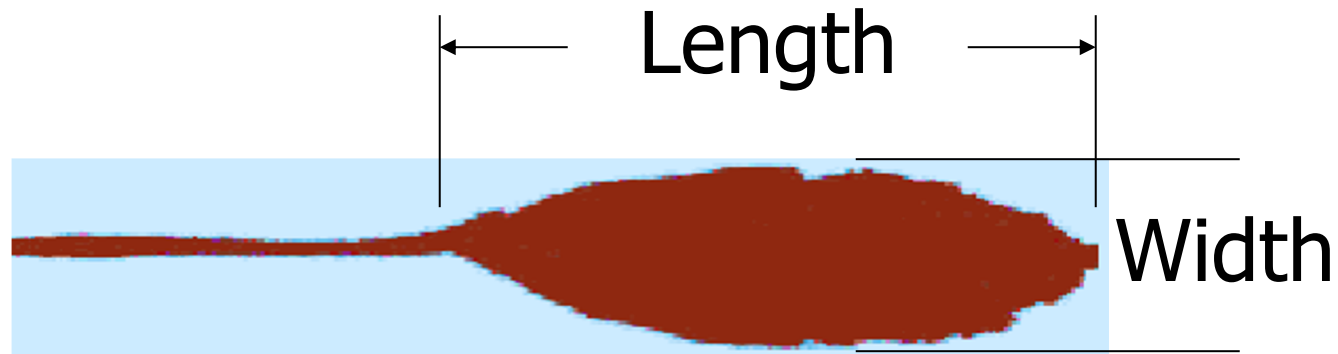
Angle of Impact

- The acute angle, relative to the target, at which a blood drop strikes the target.
- As the angle becomes more acute, the greater the elliptical shape of the stain.

90°   50°   20°   10°

Angle of Impact Calculation

Length

Width

$$\text{Angle of Impact} = \text{Inverse Sine} \frac{\text{Bloodstain Width}}{\text{Bloodstain Length}}$$

Impact Pattern - Area of Convergence (2D)

The space in two dimensions to which the directionalities of spatter stains can be retraced to determine the location of the spatter producing event.

Impact Pattern - Area of Origin (3D)

The space in three dimensions to which the trajectories of spatter can be utilized to determine the location of the spatter producing event.

The application of establishing the area of origin is only to determine whether the victim was standing, sitting or kneeling, on or just above the floor, in a chair or on a bed, etc.
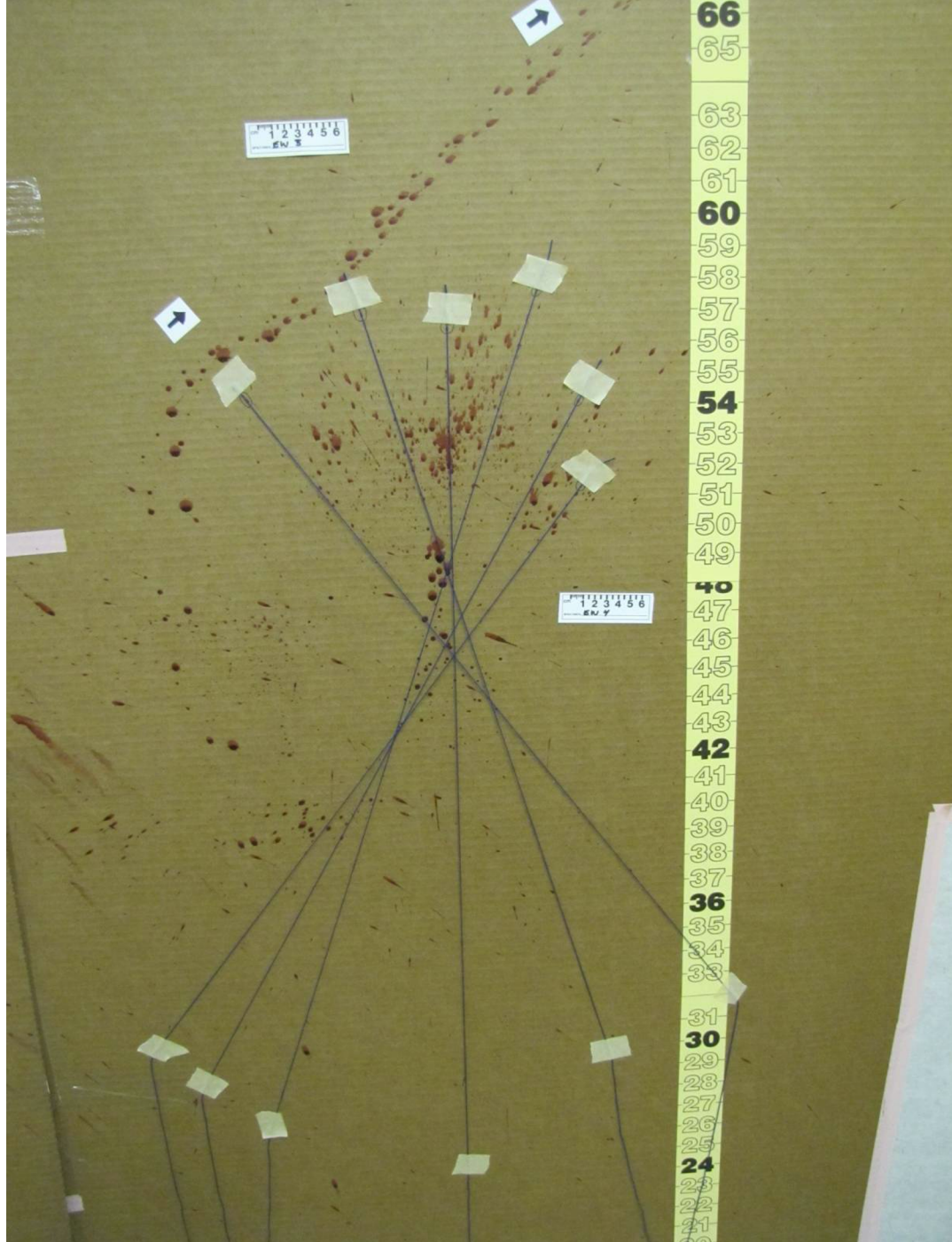
Stains should have:

- Good directionality

- Be large enough to get accurate measurement

- Not be affected by gravity

Bloodstain Pattern Analysis

Examination & Documentation Best Practices

Documentation

Proper documentation ensures integrity of the scene, provides quality presentations for courtroom testimony, and allows for outside analysis by other experts.

- Notes
- Sketches
- Photography

If done properly, a trained analyst can examine the documentation and render opinions without physically being at the scene.

Notes

- Case identifier
- Identity of the examiner(s)
- Date of activities
- Description of the scene or items
- Description of the location and absence of staining
- Description of the size, shape, distribution, and appearance of stains using recommended terminology

Roadmapping

- Developed by Toby L. Wolson of the Miami-Dade Police Department.

- Overall, medium, and close-up photographs combined with labels and scales.

- Separate pattern groups are identified and labeled and then important stains within that group are further identified and labeled.

- The labels and scales serve as "road signs" to ensure the viewer is never "lost".

- Very useful for impact patterns.
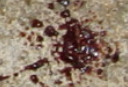
Blood Collection

- How many bleeders were present?

- Some suggest collecting one stain from each pattern.

- What about overlapping patterns?

- Think about the reconstruction of the events – what do you think you can say and will it be helpful to know whose blood it is?

- Suspect may be injured – blood trails, clean-up, etc.

- Better to collect more than not enough.

BPA on Clothing

- Blood soaks into the fibers that make up the cloth.
- The shape of the final bloodstain may bear little resemblance to the initial stain.
- Directionality usually can't be determined.
- Is it a contact stain or impact spatter?
- David Camm Case - case precedence.
- Consensus to be very cautious with bloodstain pattern classification on porous surfaces.

Prosecution

Assessing the Case

Examine the Cold Case File

Police incident reports

Follow-up reports

Crime scene photographs

Diagrams

Videos

Evidence Log

Autopsy

Laboratory reports

Victim/witness interviews

Suspect interviews

Consult with Investigator

- Is the bloodstain evidence significant/material to the case?

- If no evidence was collected/documented, why not?

Review Bloodstain/Blood Spatter Report

- How and what evidence was examined?
  - Analyst responded to crime scene.
  - Analyst examined photos from crime scene.
- How much detail is in report?
- Is the analyst still available?

Original Analyst Available

- Provide analyst original report.
- Provide access to original evidence (maintain chain of custody).
- Review report/conclusions.
- Have there been any changes in the field since the original report was done?

Original Analyst Unavailable

- Consult with Lab about original report.
- Was another analyst involved in analysis/peer review?
- Is original report sufficient for new analyst to form an opinion?
- Can analysis be re-created?

Crawford and Forensic Evidence

Melendez-Diaz v. Massachusetts, 557 U.S. 305 (2009)

Bullcoming v. New Mexico, 564 U.S. 647 (2011)

Williams v. Illinois, 567 U.S. 50 (2012)

See THE PROSECUTORS' RESOURCE ON CRAWFORD AND ITS PROGENY, *available at* https://aequitasresource.org/resources/

No Bloodstain Report Available

- Consult with Lab about preserved evidence in the case.
- Can analysis still be done?

Prosecution

Pre-trial

Trial Preparation

- Subpoena and meet with expert well in advance of trial.

- Review evidence and expert conclusions.

- Review case strategy:
  - Qualifications of the expert.
  - Foundation of the science.
  - Application of the science to the evidence of this case.
  - Potential defense arguments.

Trial Preparation

Consult with expert regarding all discovery requests from defense

Share expert's CV and other discovery with the defense in a timely fashion

Ensure expert is available to defense prior to trial

If defense is calling its own expert, share defense CV with state expert

Bloodstain Pattern Evidence at Trial

- Consult with analyst to determine most effective presentation of evidence at trial.

- Consider enlargements of exhibits or demonstrative exhibits.

- Discuss logistics of handling of evidence at trial.

Discovery Requests

- Each agency has its own rules.
- Analyst/Laboratory typically provides copies of:
  - Curriculum vitae
  - Report of analysis
  - Case notes (also called bench notes)
  - Chain of Custody
  - Standard Operating Procedures
  - Other documentation as requested

Testimony Requests

- A subpoena is required for testimony.

- Some federal examiners may require a Touhy letter to testify in state or local courts.

- Some examiners may not testify in Grand Jury proceedings as the Report of Examinations is typically sufficient.

Contact the analyst for a pre-trial conference to discuss:

- Examiner availability
- The analysis conducted
- Limitations of the science
- Current court challenges
- Suggested qualifying questions

Suggested Qualifying Questions

1. Please state your name.

2. Where are you employed?

3. What is your title?

4. How long have you been employed as a bloodstain pattern analyst?

5. What are your official duties as an examiner?

6. What is your educational background?

6. What training do you have in this area?

7. Have you testified as an expert witness before today?

8. What is bloodstain pattern analysis?

Defense Challenges - General

- Challenges to expert's qualifications
  - Trained to competency.
  - Certified by outside entity or qualified by one's agency as an examiner.
  - Proficiency tested.
  - Continuing education.
  - Research, publications, affiliations.
- Challenges to lab protocols
  - Accredited.
  - Standard operating procedures available and followed.

Frye/Daubert Challenges

What should an examiner do when there's a motion to exclude bloodstain evidence?

- ✓ Get a copy of the motion

- ✓ Work with the prosecutor to write a strong response
    - Explain the scientific basis
    - Address specific points raised in motion to exclude
    - Don't allow misleading or false statements to go unchallenged
    - Ensure hearing is requested, rather than exclusion based on motions alone

- ✓ Gather materials to support examiner's opinion

- ✓ Prepare for cross exam, using defense motion as guide

- ✓ Practice, practice, practice

- ✓ Help prosecutor prepare for proposed defense witnesses

Challenges Based on NAS Reports

2009 NAS Report

- 2006 – Congress authorized National Academy of Sciences (NAS) to conduct a study on non-DNA forensic sciences

- Important note - "The committee decided early in its work that it would not be feasible to develop a detailed evaluation of each discipline in terms of its scientific underpinning, level of development, and ability to provide evidence to address the major types of questions raised in criminal prosecutions and civil litigation." (Summary, page 7)

http://www.nap.edu/catalog/12589.html

2009 NAS Report: Key Findings

- Lack of validity testing
- Overstatement of conclusions
- Absolute certainty
- Lack of statistical support
- Subjectivity
  - Error rates, sources of error
  - Lack of scientific culture
  - Cognitive bias

- Lack of standards
  - Conclusions
  - Terminology
  - Documentation
  - Qualifications
  - Training

http://www.nap.edu/catalog/12589.html

Bloodstain Pattern Analysis

Report Writing & Testimony Best Practices

Report Writing

- Evidence Received

- Case Information

  - General facts/location of scene.

- Supplemental Reports & Materials

  - Data, reports, photos.

  - List relevant findings used to render opinions.

- Methods

  - Direct examination, microscopic examination, experimentation, examination of photographs.

Report Writing (cont'd)

- Reporting Assumptions
  - Not all stains were tested, assumption that reddish-brown staining is blood.
- Reporting Limitations
  - Poor quality photos without scales.
- Examination of Bloodstain Patterns
  - Classification of patterns.
- Opinions
  - Mechanism of deposition.
- Qualifying Statements
  - All interpretations made based on information listed in report, if more information is made available the opinions rendered may change.
- Glossary of Terms

Sequential Unmasking

- Reduce the effects of potentially biasing information that may affect a forensic scientist during their examination.

- Control the information processed by the examiner.

- Information contamination.

Use of Supplemental Data to Support Opinion

- DNA

- Footwear Examinations

- Medical Examiner's Report

Testimony

- Recommended to have a presentation.

- Explain the concepts of bloodstain pattern analysis to set foundation.

- Understand the limitations.

- Don't be tempted to render opinions on new questions or hypotheses asked.
  - Remember: the opinions rendered have been peer reviewed. This is not the time to issue new opinions

Going Forward

Develop working relationships among prosecutor, law enforcement and bloodstain pattern analyst.

Work closely with analyst to educate factfinder about bloodstain evidence.

Provide defense with appropriate notice, discovery and access to analyst.

Anticipate and rebut defense challenges.

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