

Standards and Guidelines

Scientific Working Group on Bloodstain Pattern Analysis: Topics to Consider in Preparation for an Admissibility Hearing on Bloodstain Pattern Analysis

Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN)

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Objective

This document provides a resource to prepare for an admissibility hearing on the topic of bloodstain pattern analysis (BPA).

Introduction

The Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN) comprises BPA experts from North America, Europe, New Zealand, and Australia. SWGSTAIN provides a professional forum in which practitioners in BPA and related fields can discuss and evaluate methods, techniques, protocols, quality assurance, education, and research. SWGSTAIN's ultimate goal is to use these professional exchanges to address substantive and operational issues within the field of BPA and to work to build consensus-based, or "best practice," guidelines for the enhancement of the discipline of BPA.

Statement of Purpose

SWGSTAIN has developed predicate questions and suggested answers or points that may be useful in defining and defending the discipline of BPA during an expert's testimony at an admissibility hearing. In addition to these questions and responses, SWGSTAIN has provided a resource list specific to each proposed question or topic area. This list is not intended to be comprehensive. It is provided in support of the foundational points given, as well as to provide a starting point for the collection of more detailed and/or pertinent references should such materials be required.

Although designed around the style of an admissibility hearing generally conducted in the United States, this document should be a beneficial resource to analysts practicing in similar judicial proceedings in other countries. In most settings, an admissibility hearing seeks to test the general acceptance of a scientific technique and/or discipline through the testimony of experts, not to advance the evidence yielded by that technique or dispute its role in the case-in-chief. In addition to reviewing the testimony presented at an admissibility hearing, the court may also consider and/or require the submission of materials such as scientific literature, transcripts of previous BPA testimony, previous appellate and/or trial court decisions, and/or the qualifications of any expert that may provide testimony at any subsequent admissibility hearing. A BPA expert should be prepared to provide documentation of his or her training and experience as a part of this process. Should an admissibility hearing be ordered by the court, the BPA expert should strongly consider using visual aids to demonstrate major points in support of the scientific validity and methodology

of BPA.

Admissibility Standards

Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993)

Daubert-based admissibility proceedings seek to:

1. Provide evidence that the methodology has been tested;
2. Provide evidence that the methodology has been subjected to peer review and publication;
3. Determine the error rate(s) associated with the methodology; and/or
4. Provide evidence that the methodology has been generally accepted by the relevant scientific community.

Frye v. United States, 54 App. D.C. 46, 293 F. 1013, 1014 (1923)

Frye-based admissibility proceedings seek to:

1. Determine if the expert testimony will assist the jury in trying the case;
2. Establish that the expert testimony is based upon scientific principles that have been widely accepted in the field;
3. Establish that the witness has been qualified as an expert in the relevant field; and/or
4. Establish the credibility of the witness.

Federal Criminal Code and Rules, Title 28, Section VII, 702 (1975)

Federal Rule 702 admissibility proceedings seek to:

1. Determine that the testimony is based upon scientific testing;
2. Determine that the testimony is a product of reliable scientific principles and methods; and/or
3. Determine that the witness has applied the scientific principles and methods reliably to the case.

Predicate Questions

The sound practice of BPA involves continual review of the discipline's scientific literature. To assist BPA practitioners in preparation for their expert testimony, each of the following proposed predicate questions is followed by guidance concerning what the question should seek to demonstrate as well as an example and/or a suggested resource list.

1. What is BPA?

The answer should include a definition of BPA and an explanation of how BPA can be used to

answer specific question(s) or to reconstruct events. A general definition may state that BPA is a field of study that relies on the fact that blood is a fluid, and as such, it adheres to physical laws. Therefore, bloodstain patterns are broadly reproducible under similar conditions. BPA is the study of the size, shape, distribution, and location of bloodstains in order to establish the physical events that gave rise to their origin.

Example:

BPA is the scientific study of the static consequences resulting from dynamic bloodshedding events. The study involves detecting, describing, and analyzing the size, shape, distribution, number, location, and pattern of bloodstains, as well as the nature of their target surfaces and the relationship among various bloodstains at the scene. Potential target surfaces include virtually any surface capable of sustaining detectable bloodstains—for example, the victim, the victim's clothing, the suspect, the suspect's clothing, any weapon(s), any vehicle(s), or any other surfaces, such as walls, floors, or ceilings.

Suggested Resources

Bevel, T. and Gardner, R. M. *Bloodstain Pattern Analysis: With an Introduction to Crime Scene Reconstruction*. 2nd ed., CRC Press, Boca Raton, Florida, 2002.

DeForest, P. R., Gaensslen, R. E., and Lee, H. C. *Forensic Science: An Introduction to Criminalistics*. McGraw-Hill, New York, 1983.

James, S. H., Kish, P. E., and Sutton, T. P. *Principles of Bloodstain Pattern Analysis Theory and Practice*. Taylor & Francis-CRC Press, Boca Raton, Florida, 2005.

MacDonell, H. L. *Bloodstain Patterns*. 2nd rev. ed., Golos Printing, Elmira, New York, 2005.

2. What is the purpose of BPA?

The answer should include an explanation of how BPA is used to answer specific question(s) and/or to reconstruct events.

Example:

The purpose of the scientific study of BPA is to provide information about the bloodshedding events that produced patterns on the targets under investigation. This purpose may include providing insight(s) into (a) the position of the victim(s) at the time of bloodshed, (b) the position of the subject(s), (c) the origin(s) of the bloodstains, (d) the sequence of events that created the patterns, (e) the movement(s) of the victim, suspect, or objects at the scene during and after bloodshed, (f) the agreement or disagreement of these bloodstains with statements provided by the victim(s), suspect(s) or witness(es), etc.

Suggested Resources

Bevel, T. and Gardner, R. M. *Bloodstain Pattern Analysis: With an Introduction to Crime Scene Reconstruction*. 2nd ed., CRC Press, Boca Raton, Florida, 2002.

DeForest, P. R., Gaensslen, R. E., and Lee, H. C. *Forensic Science: An Introduction to Criminalistics*. McGraw-Hill, New York, 1983.

James, S. H., Kish, P. E., and Sutton, T. P. *Principles of Bloodstain Pattern Analysis Theory and Practice*. Taylor & Francis-CRC Press, Boca Raton, Florida, 2005.

MacDonell, H. L. *Bloodstain Patterns*. 2nd rev. ed., Golos Printing, Elmira, New York, 2005.

3. What are the principles of BPA?

An answer should reference the use of mathematics and scientific principles from biology and physics as the basis for the study of BPA.

Example:

BPA applies mathematics and scientific principles from biology and physics (e.g., trigonometry, characteristics of blood, force/acceleration, surface tension, cohesive forces). Its practice, therefore, embraces methods that are characteristic of the natural sciences.

Suggested Resources

Bevel, T. and Gardner, R. M. *Bloodstain Pattern Analysis: With an Introduction to Crime Scene Reconstruction*. 2nd ed., CRC Press, Boca Raton, Florida, 2002.

DeForest, P. R., Gaensslen, R. E., and Lee, H. C. *Forensic Science: An Introduction to Criminalistics*. McGraw-Hill, New York, 1983.

James, S. H., Kish, P. E., and Sutton, T. P. *Principles of Bloodstain Pattern Analysis Theory and Practice*. Taylor & Francis-CRC Press, Boca Raton, Florida, 2005.

MacDonell, H. L. *Bloodstain Patterns*. 2nd rev. ed., Golos Printing, Elmira, New York, 2005.

4. Briefly describe the methodology used when conducting BPA.

The answer should include an explanation of how BPA uses a scientific process; therefore, the analysis of a bloodstain(s) follows a generally accepted methodology that includes information gathering, observation, documentation, analysis, evaluation, conclusion, and technical review. The scientific method is appropriate for describing BPA methodologies. The scientific method endeavors to identify a problem, gather relevant data, formulate a hypothesis, and verify the analysis by experience and/or experiment.¹ An explanation and/or description of what critical elements are performed at each step of the process may be needed.

Example:

Characterization of BPA Method:

Established methods include gathering information relevant to the bloodshedding event, formulating a question to be answered, making careful observations of the available data, describing and documenting those observations and data, producing objective analyses by applying specific scientific principles, and then systematically evaluating those analyses. Systematic evaluation of these analyses may require the application of established scientific facts, the experimental production or reproduction of comparable data under specified conditions, and/or the testing of alternative explanatory mechanisms under other controlled conditions that apply to the proposed analysis under review. Another vital characteristic of this systematic evaluation is to ensure objectivity through technical and/or peer review of this analysis by another analyst practicing in the field.

Scientific methodology cannot be reduced to a list of activities but involves a systematic approach to the recognition, processing, and assessment of physical evidence resulting in a scientific explanation.

Suggested Resources

Anderson, J. W. Sherlockian theories: Lessons from the greatest detective who *never* lived, *Canadian Society of Forensic Science Journal* (1992) 25:123–133.

Gardner, R. M. The role of logic in bloodstain analysis and crime scene reconstruction, *International Association of Bloodstain Pattern Analysts News* (1992) 8(3):15–19.

James, S. H., Kish, P. E., and Sutton, T. P. *Principles of Bloodstain Pattern Analysis Theory and Practice*. Taylor & Francis-CRC Press, Boca Raton, Florida, 2005.

Kish, P. E. and MacDonell, H. L. Absence of evidence is not evidence of absence (Guest Editorial), *Journal of Forensic Identification* (1996) 46:160–164.

Nordby, J. *Dead Reckoning: The Art of Forensic Detection*. CRC Press, Boca Raton, Florida, 1999.

Nordby, J. Science is as science does: The question of reliable methodologies in “real science,” *Shephard's Expert and Scientific Evidence Quarterly* (Winter 1995) 2(3).

5. Are the scientific principles and methods you described used in fields other than BPA?

Example:

Yes. The scientific methodology is used in one form or another in all scientific processes, research, and other forensic disciplines. The scientific principles most relevant to BPA are adopted from the disciplines of mathematics, biology, and physics.

Suggested Resources

Adam, J. R., Lindblad, N. R., and Hendricks, C. D. The collision, coalescence, and distribution of water droplets, *Journal of Applied Physics* (1968) 39:5173–5180.

Ching, B., Golay, M. W., and Johnson, T. J. Droplet impacts upon liquid surfaces, *Science* (1984) 226:535–537.

Harlow, F. H. and Shannon, J. P. Distortion of a splashing liquid drop, *Science* (1967) 157:547–550.

Jones, E. R. and Childers, R. L. *Contemporary College Physics*. Addison-Wesley, New York, 1990.

6. Are the methods used in BPA generally accepted in the scientific community?

Example:

Yes. There are many published studies that support their general acceptance in the scientific community, as well as case law to support their validity.

Suggested Resources

Betz, P., Peschel, O., Stiefel, D., and Eisenmenger, W. Frequency of blood spatters on the shooting hand and of conjunctival petechiae following suicidal gunshot wounds to the head, *Forensic Science International* (1995) 76:47–53.

Karger, B., Nüsse, R., Schroeder, G., Wüstenbecker, S., and Brinkmann, B. Backspatter from experimental close-range shots to the head. I. Macrobackspatter, *International Journal of Legal Medicine* (1996) 109:66–74.

Karger, B., Nüsse, R., Tröger, H. D., and Brinkmann, B. Backspatter from experimental close-range shots to the head. II. Microbackspatter and the morphology of bloodstains, *International Journal of Legal Medicine* (1997) 110:27–30.

Ristenbatt, R. R. and Shaler R. C. A bloodstain pattern interpretation in a homicide case involving an apparent “stomping,” *Journal of Forensic Sciences* (1995) 40:139–145.

7. Is BPA used by the forensic science community throughout the world? How long has it been used?

Example:

Yes. Studies and papers date its use back to the late 1800s, with routine use since the 1970s. BPA is currently used in many countries, including the United States, the United Kingdom, the Netherlands, Canada, New Zealand, and Australia.

Suggested Resources

Balthazard, V., Piédelièvre, R., Desoille, H., and Dérobert, L. *Étude des gouttes de sang projeté*. Presented at the 22nd Congress of Forensic Medicine of the French Language, Paris, France, 1939.

Carter, A. L. and Podworny, E. J. Bloodstain pattern analysis with a scientific calculator, *Canadian Society of Forensic Science Journal* (1991):37–42.

Illes, M. Canadian bloodstain pattern analysis in the Netherlands, *Canadian Society of Forensic Science Journal* (2001) 34:167–171.

Kirk, P. L. Blood—A neglected criminalistics research area. In: *Law Enforcement Science and Technology*. 1st ed., Academic Press, London, 1967, pp. 267–279.

MacDonell, H. L. and Bialousz, L. *Flight Characteristics and Stain Patterns of Human Blood*. U.S. Department of Justice, Law Enforcement Assistance Administration, Washington, D.C., 1971.

Piotrowski, E. *Origin, Shape, Direction and Distribution of the Bloodstains Following Head Wounds Caused by Blows*. [Translated from German]. The Institute of Forensic Medicine of the K. K. University, Vienna, Austria, 1895.

8. Are you aware of published studies that address the reliability and scientific validity of BPA?

Example:

Yes. The procedures have been extensively studied and have been shown to be scientifically valid and to produce reliable results. (The BPA analyst should be prepared to cite studies pertinent to the analyses conducted in an individual case.)

Suggested Resources

Carter, A. L. The directional analysis of bloodstain patterns theory and experimental validation, *Canadian Society of Forensic Science Journal* (2001) 34:173–189.

MacDonell, H. L. and Bialousz, L. *Flight Characteristics and Stain Patterns of Human Blood*. U.S. Department of Justice, Law Enforcement Assistance Administration, Washington, D.C., 1971.

9. Have the scientific principles used in BPA been published in peer-reviewed journals?

Example:

Yes. Numerous peer-reviewed articles in scientific journals spanning many years support BPA. In addition, the principles and methods used have been presented at scientific meetings hosted by professional organizations and government agencies in the United States and other countries.

Suggested Resources

MacDonell, H. L. Interpretation of bloodstains—Physical considerations. In: *Legal Medicine Annual*, C. Wecht, ed., Appleton-Century Crofts, New York, 1971.

Pizzola, P. A., Roth, S., and DeForest, P. R. Blood droplet dynamics—I, *Journal of Forensic Sciences* (1986) 31:36–49.

Pizzola, P. A., Roth, S., and DeForest, P. R. Blood Droplet Dynamics—II, *Journal of Forensic Sciences* (1986) 31:50–64.

10. Are there professional associations related to bloodstain pattern analysts?

Example:

Yes. These would include, but are not necessary limited to, the International Association of Bloodstain Pattern Analysts (IABPA), the International Association for Identification (IAI), the Association for Crime Scene Reconstruction (ACSR), local/regional associations, the American Academy of Forensic Sciences (AAFS), and the Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN). Any group or association listed must have BPA training and/or BPA content as part of its meetings or discussions.

11. What is SWGSTAIN?

Example:

The acronym SWGSTAIN denotes the Scientific Working Group on Bloodstain Pattern Analysis. It is an FBI-sponsored, professional forum of bloodstain pattern analysts from international, federal, state, local, and private laboratories, as well as law enforcement agencies. The group's mission is to establish guidelines for best practices and to develop and advance the discipline of BPA.

12. Describe elements of the analysis process that ensure the reliable application of scientific methodologies to bloodstain pattern cases.

The answer should include an explanation of some or all of the following concepts that can be employed to monitor analyst performance: internal and/or external proficiency testing, competency testing, technical review, and/or reanalysis/coanalysis by a qualified analyst.

13. Is there an error rate associated with BPA methodology?

The answer should include an explanation that no error rate is associated with the methodology of BPA when it is conducted properly. Analysts should be prepared for additional questions regarding measurement errors and/or analyst errors. It should be emphasized that analyst error is

different from errors in the method and that controls such as proficiency and competency testing may be used to evaluate analyst performance.

Suggested Resources

Laternus, P. Measurement survey, *International Association of Bloodstain Pattern Analysts News* (1994) 10(3).

Willis, C., Piranian, A. K., Donaggio, J. R., Barnett, R. J., and Rowe, W. F. Errors in the estimation of the distance of fall and angles of impact blood drops, *Forensic Science International* (2001) 123:1–4.

14. What administrative controls are used to ensure that BPA results are reliable?

The answer should include an explanation of how case-file review and internal/external audits provide a means of administrative control for both form and content. Administrative review is an evaluation of the report and supporting documentation for editorial correctness.

Testimony Preparation

In preparation for expert testimony, the analyst needs to prepare for and/or be conversant in the following topic areas.

1. Expert qualifications (curriculum vitae)

1.1. Formal training in BPA.

1.2. Years of experience practicing BPA and number of cases.

1.3. Education in related fields (e.g., physics, mathematics, biology).

1.4. Continuing education in BPA.

1.5. Memberships in relevant organizations.

1.6. Publications/presentations in BPA.

1.7. Instruction given in BPA.

1.8. Court experience. (It may be useful to make available a list of your previous BPA testimonies.)

1.9. Prior testimony (i.e., transcripts).

2. Analyst error: differing opinions and/or conclusions do not necessarily constitute an error. The analyst should be able to explain how he or she minimizes the impact of potential sources of analyst error, such as:

2.1. Lack of complete and factual information.

2.2. Lack of training.

2.3. Lack of continuing education.

- 2.4.** Lack of experience.
 - 2.5.** Lack of objectivity.
 - 2.6.** Incorrect application of the methodology.
 - 2.7.** Measurement error.
 - 2.8.** Methodological error.
- 3.** Proficiency testing. (If you do not participate in any proficiency-testing program, then consider the following to demonstrate proficiency.)
 - 3.1.** Emphasize that all of the conclusions given have been peer-reviewed.
 - 3.2.** Reiterate your training, education, and experience in BPA.
 - 3.3.** Demonstrate that you are current in literature review, experimentation, and case exposure.
 - 3.4.** Follow a documented quality assurance program.
- 4.** Limitations of BPA
 - 4.1.** The circumstances of the examination, e.g., remote analysis,² that may limit conclusions drawn.
 - 4.2.** The inability to preserve and document the scene.
 - 4.3.** The inability to preserve and document the evidence.
 - 4.4.** A lack of information from other examinations, e.g., DNA, medical examiner reports.
 - 4.5.** Insufficient pattern information to provide an analysis
 - 4.6.** Numerous, complex, or unusual patterns that make it particularly difficult to render an opinion.
 - 4.7.** Previous, unrelated bloodshed.
- 5.** Validation Studies
 - 5.1.** BPA is validated through studies that demonstrate pattern reproducibility and the reliability of the methodology.
 - 5.2.** BPA is validated through experimentation and research.
 - 5.3.** The comprehensive bibliography of BPA demonstrates that it is a valid scientific discipline.
- 6.** Standard operating procedures (SOP) and quality assurance (QA) practices
- 7.** Precedent resources

7.1. *American Law Review*.

7.2. LexisNexis (<http://www.lexisnexis.com/>).

7.3. James, S. H., Kish, P. E., and Sutton, T. P. *Principles of Bloodstain Pattern Analysis Theory and Practice*. Taylor & Francis-CRC Press, Boca Raton, Florida, 2005.

Notes

1. *Encyclopedia of Science and Technology*. 9th ed., McGraw-Hill, 2002.

2. Remote analysis can be defined as the examination of bloodstain pattern cases without direct observation of the crime scene or evidence (e.g., relying upon photographs, video, sketches).