BL OODSTAIN
PATTERN
ANALYSIS
LEVEL 1 LAB MANUAL

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BLOODSTAIN PATTERN ANALYSIS
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Introduction to Bloodstain Pattern Analysis

The focus of bloodstain pattern analysis (BPA) is to examine the size, shape, and distribution of bloodstains following a bloodshed event, to establish the types of activities and mechanisms that produced them.

- Bloodstain pattern analysis is the study of “static” bloodstains.
- These bloodstains are normally associated with the aftermath of a violent event and they provide information specific to the events that occurred.
- Bloodstain patterns are predictable and reproducible.
- You can determine the direction a bloodstain was moving by its appearance (shape).
  - A bloodstain will always point in the direction it is moving.
- The size of projected bloodstain has a direct relationship to the speed at which it is traveling.
  - A small drop is moving much faster than a larger one.

The majority of forensic disciplines provide information regarding the “WHO” of the crime.

- Examples:
  - DNA
  - Fingerprints

Forensic pathology often times answers the “WHAT” of the crime.

- Bloodstain pattern analysis also provides information regarding the “WHAT” of the crime.
  - Bloodstain pattern analysis brings to the investigation the ability to define those events that could or could not have occurred during bloodshed.

The primary functions of a BPA analyst are the following:

1. To define or categorize specific stains and patterns found.
2. Attempt to identify the nature of the event causing the pattern.
Using the information available through bloodstain pattern analysis, certain objectives and conclusions can be made. 

- This includes observing and identifying the following:
  - The direction a given blood drop was traveling
  - The angle of impact
  - The area above the target surface from which the droplet originated
  - The nature/type of the force
  - The direction from which the force was delivered
  - The nature of an object used in applying force
  - Minimum number of blows struck during the incident
  - The relative position of the suspect victim and related objects during the incident
  - The possible sequencing of multiple events associated with the incident
Brief History

Bloodstain evidence is not new to the criminalist, as references exist as far back as 1894 in Germany. The 150-year written scientific history is a longer than the history of fingerprint analysis. The importance of history is that it allows a person to understand the present and to forecast the future, because of events of the past. The discipline is constantly evolving and becoming better defined over time.

Historical Development

1856: J. B. Lassaigne
- Discussed fly spots.

1863: John and Theodric Beck
- Discussed specific patterns and correlation of patterns to wounds.

1880: Henry Faulds
- Discussed the use of bloody fingerprints.

1882: Charles Tidy
- “Few things hold so important a place as or involve of greater nicety, than determining the precise nature of various [blood] spots or stains found on fabrics and instruments.”

1895: Eduard Piotrowski
- His work has been translated from German text into both German and English as Concerning the Origin, Shape, Direction and Distribution of Bloodstains Following Head Wounds caused by Blows.
- Sought to understand spatter and expiratory blood.
- Discussed and defined directionality of droplets based on shapes and tails.
- Recognized and explained cast-off patterns.
1901: Albert Florence
- Created a complete system (taxonomy) for classifying bloodstains.

1904: Hans Gross
- Authored the *Handbook for Investigators*.
- Original version in German, and subsequent translation in English.
- Spent 30 pages describing the use of bloodstain patterns.

1914: Ernest Ziemke
- Authored the chapter “Bloodstain Patterns” in Theodor Lochte’s *Techniques of Police Investigation*.
  - “Blood tracks are the most important tracks that stay behind after a crime is committed. Very often they alone have been of significant importance for the conviction of the suspect.”
  - “Based on our experience and experiments we want to point out that it is necessary to be cautious and not draw conclusions from a single or very few blood tracks. This happens quite often. Only when a large number of bloodstains are examined and compared, is it possible to exclude errors.”
- Discussed wave cast-off (satellite stains) and directionality of stains.
- Discussed cast-off patterns and pattern transfers and described a case in which he compared a bloody shoe mark and found where the 14 shoe nails left the pattern.
- Discussed spatter and whether spatter would be found on a suspect in all cases.

1935: Svennson and Wendel
- Rikospaikka-Tutkimus “Criminal Investigation.”
- Finnish criminal investigation reference.
- Called on the work of Hans Gross and spent significant number of pages explaining the use of bloodstain patterns.

1939: Victor Balthazard et al.
- Made a presentation to Congress of Forensics Medicine.
- Described and explained spatter, the parabolic nature of blood flight paths.
- Introduced “stringing” concepts, although he did not use the word “stringing.”

1941: John Gohringer
- Doctoral studies at the University of Heidelberg.
- Thesis “Is It Possible to Establish the Falling Height and Directionality of Dropped Down Blood from the Appearance of the Stain and Various Targets.”
  - Gohringer’s inspiration was Balthazard’s effort and paper.
  - Gohringer was a U.S. citizen. Before completing his study, he spent seven months as an “internee” of the German government before being released.
1947: J. G. Wilhelm

- Study in the Practice of Criminalistics.
- Gave mention to bloodstain pattern to include the following:
  - Stain shape and impact angle
  - Pattern transfers

1953: Paul Kirk

- In 1953, he included a chapter entitled “Blood Physical Investigation” in his book *Criminal Investigation*.
- Worked on the Sam Sheppard case in Ohio in 1955.
- His affidavit in support of Sheppard is a very detailed description of some of his beliefs on bloodstain pattern analysis:
  - Cast-Off patterns, spatter patterns, and blood trails

1960: Jozef Radzicki

- Published *Bloodstain Prints in the Practice of Technology* in Warsaw, Poland.
  - Developed a more effective taxonomy based on the following:
    - Bloodstain from extravasations—drops, gushes, and pools
    - Bloodstains from application of instruments—spatter, cast-off, pattern transfers
    - Bloodstains from wiping or removal of blood
  - Commented on the importance of target surface as it affects the resulting stain.

1970: MacDonell/Bialousz

- Authored *Flight Characteristics and Stain Patterns of Human Blood*.
- LEAA funded study (the Orange Book).

1983: International Association of Bloodstain Pattern Analysts (IABPA) was formed.

- Expressed need to enhance knowledge and education in the discipline.
- Provided yearly training conferences and committee effort to evaluate issues related to bloodstain pattern analysis.

1984: Laber and Epstein

- Authored *Experiments and Practical Exercises in Bloodstain Pattern Analysis*.
- Lab manual used in the Minnesota course

1989: Eckert and James

- Authored *Interpretation of Bloodstain Evidence at Crime Scenes*.
- Original publisher was Elsevier Press.
- CRC Press picked up the 2nd edition.
- 2nd edition was significantly expanded and enhanced.
1990: International Association for Identification (IAI)
- Removed bloodstain pattern analysis from the crime scene discipline and identified it as a separate discipline.
- IAI now offers Bloodstain Pattern Examiner certification.

1996: Stuart James (Editor)
- Authored *Scientific and Legal Applications of Bloodstain Pattern Interpretation*.

1997: Tom Bevel and Ross Gardner
- Authored *Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction*.
  - 3rd edition published in 2007

2000: SWGSTAIN
- Originated as the FBI Scientific Working Group for Bloodstain Pattern Analysis (SWGSTAIN).
- Formed in March 2000, with expressed purpose to develop “best practices” for the discipline and create common ground (e.g., differences between IABPA, IAI).
- Now located at the Midwest Forensic Resource Center, Ames, Iowa.

2001: Anita Wonder
- Authored *Blood Dynamics*.
- Good document but interjected non-Newtonian fluids (man-made liquids such as paint and other chemicals).

2015: National Institute of Standards and Technology
- A metrology laboratory and a non-regulatory agency of the United States Department of Commerce.
- The mission is to promote innovation and industrial competitiveness.
- Bloodstain Pattern Analysis is now a subcommittee of NIST.
**Historical Development Timeline**

1856 J.B. Lassaigne
1863 John and Theodric Beck
1880 Henry Faulds
1882 Professor Charles Tidy
1895 Dr. Edward Piotrowski
1901 Albert Florence
1904 Hans Gross
1914 Ernest Ziemke
1935 Svennson and Wendel
1939 Victor Balthazard et. al.
1941 John Gohringer
1947 J.G. Wilhelm
1953 Paul Kirk
1960 Jozef Radzicki
1970 MacDonnel/Bialousz
1983 IABPA was formed
1984 Laber and Epstein
1989 Eckert and James
1990 BPA removed from crime scene
1993 H. MacDonnell
1996 Stuart James
1997 Bevel/Gardner
2000 SWGSTAIN
2001 Anita Wonder

**FIGURE 2.1 Historical Development Timeline**