

**SANTA BARBARA COUNTY
SHERIFF'S OFFICE
FORENSICS UNIT**

BLOODSTAIN PATTERN P H O T O - DOCUMENTATION

1.0 Overview

1.1 Crime Scene Response

Crime scenes often contain multiple bloodstains that can be examined and interpreted in order to help establish the nature of the crime (for example, a beating versus a gunshot wound), and help assist in determining the series of events that may have occurred to produce those stains. These determinations may be used to support or refute statements given by witnesses or possible suspects. Bloodstain patterns present may prove to be either consistent or inconsistent with the information regarding the event. The scope of the analysis at the scene will depend upon the availability of the evidence, the information provided to the technician at the scene, and may only be preliminary in nature until further laboratory tests are concluded. The mere presence or absence of suspected blood in and of itself may be of value, independent of any pattern that may or may not be present. The technician's presence in the crime scene provides the best opportunity to document the bloodstains in place. The technician in the crime scene can provide the investigator with the most information about the locations where the suspected blood evidence can be found. The overall documentation of all patterns in place is very beneficial to the investigation. The conclusions drawn should be more concerned with the total picture given by the patterns present and the weight of individual stains should be less important.

The following pieces of information assist the DOJ Criminalist/ Forensic Technician/ Detective in accurately interpreting a bloodstain pattern:

- The type of weapon.
- The location of the wound on the victim(s) and/or suspect(s).
- The effect the wound would have on the person and other medical conditions that would affect how the victim could react.
- The clothing worn by the bleeding person or people.
- The history of the location (clean house vs. bar with daily fights).
- The environmental conditions since the incident.
- The actions of first responders and emergency personnel.

The above information may not be known at the time, but can be relayed to the Forensics Unit as soon as it becomes available to the investigators.

Whenever possible, and depending upon the circumstances and complexity of the scene, it is preferable to have a DOJ Criminalist respond to the scene to assist with interpretation of bloodstain patterns.

1.2 Photographs of Crime Scenes

When bloodstain pattern analysis is needed at a crime scene, the Forensics Supervisor will call the DOJ Crime Lab Supervisor to request the assistance of a DOJ Criminalist. The DOJ Criminalist(s) will typically respond to the crime scene location and will be provided with all necessary information. The DOJ criminalist will need to be cautious about conclusions depending on how much information they have. Photo-documentation of the Bloodstain patterns will be completed by the SBSO Forensics Unit as well as by the DOJ Criminalist.

The following additional information should be obtained for possible interpretation from photographs:

- Dimensions of the scene and blood patterns.
- Relationship of items in the scene.
- The condition of the surface with stains (ex: porosity, texture, contaminants present, and orientation to gravity).

1.3 Items submitted to the DOJ Lab

Evaluation of patterns on objects, such as suspected weapons and clothing items, can be conducted by the DOJ Crime Lab. This evaluation may be used to assist Forensics/Criminal Investigations personnel in determining which stains are likely to be most probative. DOJ lab evaluations may also be used to determine if a suspect, witness, or victim statement is more likely than alternative scenarios. Determinations regarding the number of likely suspects may also involve bloodstain interpretation conducted by the DOJ Crime Lab.

Analysis of bloodstain patterns to assist in the selection of stains for DNA typing does not necessarily require a report on the bloodstain interpretation. The stains on a single item are rarely enough for a thorough interpretation. Documentation of the patterns represented is required and should consist of a written report and photo-documentation. Sketches and measurements may also be needed in certain cases.

2.0 Materials

Materials (requirements vary- the materials listed are used where applicable).

1. Rulers or other suitable measuring devices.
2. Protractor with a zero line.
3. Loupe or other suitable magnifying glass.
4. String, tripods, hole reinforcement stickers.
5. Digital camera and associated accessories.
6. Paper and pens or digital notepad.
7. Laser light pen.
8. Calculator or trigonometric tables.

9. Graphic tape.
10. Presumptive blood testing reagents such as HEXAGON OBTI or Phenolphthalein Dischaps Blood Test Reagent.

11. Enhancement reagents such as luminol, leucocrystal violet, or amido black.
12. Personal Protective Equipment (PPE) - gloves, booties, Tyvek suits, masks.

3.0 Preliminary Concerns

Wear the appropriate PPE for the crime scene to prevent exposure to hazards and to prevent contamination of the evidence. Refer to the Santa Barbara County Sheriff's Office Blood Borne Pathogen Exposure Control Plan for further information.

4.0 Bloodstain Pattern Photography

4.1 Overview

In general bloodstain pattern photography is no different than any other type of crime scene photography, although it can be more of a challenge to document due to the fact that the patterns are very similar and can be difficult to differentiate one from another. However, due to the nature of the stains and the information that can be derived from them, it is imperative that the bloodstain/spatter photographs depict enough information to lend themselves to further analysis in order to reconstruct or answer additional questions that may arise during the investigation.

Note: Not all bloodstain scenes will require the extensive amount of bloodstain documentation outlined in the following method. Each scene must be assessed on a case-by-case basis. In some cases, only the general location of the bloodstain patterns will be documented using the Road Mapping technique and only a few of the individual stains may be taken close-up. However, no matter how in-depth the photo-documentation of bloodstain patterns is at the scene, the individual viewing the photographs must be able to know the orientation and the location of each bloodstain within the crime scene.

4.2 Overall Scene Photographs

Take the initial overall photographs as you would with any other scene. These will document the scene as it was before placing any rulers and/or evidence placards and before any actual processing of the scene has taken place.

It should be noted that once the evidence placards have been placed within the scene and photo-documentation begun, they should not be moved or relocated. The positioning and orientation of the number stands provides assistance to anyone reviewing the photographs at a later date as to the location and orientation of the stains within the scene.

4.3 Suggested Bloodstain Pattern Photographs (Road Mapping Technique)

- 4.3.1 Use rulers to demonstrate the bloodstain patterns overall orientation in the room or on a wall. These types of photographs are not meant to show

detail.

Place at least 2 long rulers along the pattern in such a way that the distance from the wall and overall size of pattern is present in one photograph. This would also be the same for a pattern on the wall, i.e. showing distance from ground and overall spread of pattern on the wall.

4.3.2 Next place placards (number stands, 4"x6" index card, Post-it notes, etc.) next to the various bloodstain patterns of interest, especially when dealing with more than one pattern in a single location. You must first be able to recognize the different bloodstain pattern types that are present in the scene.

4.3.3 Label each pattern with a sequential number such as pattern 1, pattern 2 or use a letter (pattern A, pattern B, etc.) each representing a different bloodstain pattern.

4.3.4 Determine which individual stains or a group of stains within a given pattern are of interest. These may include well-defined stains that will show angle or those stains used to determine the type of stain present.

Label each of the stains within the pattern with a sub-label. These labels can be created using adhesive notes (Post-it notes) or combined with adhesive paper scales.

1. Use a bold marker to mark on the label.
2. Make sure that these markers or at least the bold marking depicting the sub- labels are readable from several feet away.
3. Place the sub-label adjacent to the pattern or stain in question.
4. The adhesive paper scales can be positioned in an "L" shape near the stain or around the entire stain, if necessary.

5. Take another orientation photograph with all the labels in place showing the relationship between those different placards and the bloodstains they represent. These will represent landmarks in the overall photographs the bloodstain patterns, whether present on the floor and/or wall.

6. Make sure that the pattern types are at least readable in these overall photographs. This will provide the overall pattern and scene relationships.

7. Take additional photographs of each pattern type (pattern 1, pattern 2, etc.). These should be taken with the camera lens perpendicular to the surface. If the single pattern area is too large then additional photographs depicting portions of that pattern (pattern 1) will be taken. These photographs should be taken close enough to see the sub-labels. Take as many photographs as necessary and make sure that each photograph can be orientated to the larger overall photograph.

8. Next, close-up photographs of the individual sub-labeled stains within the specific pattern should be taken. Again, these should be taken with the camera lens perpendicular to the surface. These stains

should always have adhesive or other scales in them clearly showing the pattern sub-label.

- i. As you take the photographs, consider making a photo log. It can be generated after the fact, however, based on the number and similar appearing photos generating the log after the fact may be difficult, especially with the overall photographs before labeling.

4.4. Suggested Bloodstain Pattern Photographs (Grid Method)

This method uses a grid in order to help organize the sequence of photographs taken.

- 4.4.1 Grid off the area such as a wall in approximately 2'x2' squares (size of grid may depend on area being processed) with tape or string. The grid squares should not be larger than approximately 2'x2'. The larger it is, the harder it will be to get the entire field in the photograph so that all identifiers and patterns can be seen clearly. Be careful not to move items in the scene in order to lay the grid lines.
- 4.4.2. Take overall photographs of the bloodstain patterns before any analysis. The camera lens should be perpendicular to the surface for as many photographs as possible.
- 4.4.3. Take an overall picture of the grid before marking each square within the grid with a number or letter.
- 4.4.4 Take an overall photograph of the grid with the numbering/lettering system in place, with the camera lens perpendicular to the surface.
- 4.4.5 Take close-up photographs of the stains of interest within each individual grid square, marking each stain of interest with an identifier and ruler (an adhesive tape ruler can be used). The grid square should fill-up the entire frame of the photograph. Be aware of the placement of the tripod legs as to not disturb any stains or transfer stains from one area to another.
- 4.4.6 Make sure that at least one of the photographs shows which grid square you are photographing and its relationship to the individual or groups of stains of interest within the grid.
- 4.4.7 A photo log is helpful and may be necessary for some crime scenes at the time you are taking the photographs.

5.0 Procedure

The following lists some of the basic measurements and observations that can be made at a crime scene involving bloodstain evidence. Not all crime scenes involving bloodshed will require bloodstain pattern analysis and, depending on the scene and what questions are being asked, any one or a combination of specific determinations regarding bloodstain pattern analysis may be done.

The following procedures will be conducted by the DOJ Criminalist at a crime scene. The contents explained below are for informational purposes only.

5.1 Determination of Direction of Travel

1. Where possible (surface dependent) the direction of travel will be determined based on the stain's shape.
 - a. The tail of the parent drop will point in its direction of travel.
 - b. The tail of the wave cast-off points back to the parent drop.
 - c. Blood in motion falling on a horizontal surface may show scalloped edges (produced at an angle of less than 90°) on the side indicating the direction of travel of the source.

5.2 Determination of Angle of Impact (Impact Angle)

1. Obtain the width and length of the stain in millimeters (mm). The impact angle can be determined by using the following formula:

$$\text{impact angle} = \sin^{-1} \left(\frac{\text{width of stain CW in mm}}{\text{length of stain (L in mm)}} \right)$$

NOTE: the width and length of the stain should be measured by calipers or a measuring device with fine divisions less than 1 mm.

2. Other methods may be used to estimate the angle of impact such as using an ellipse template or an angled light source. Include a measuring device in the photographs to allow the photographed stains to be measured in Photoshop.

5.3 Point or Area of Convergence

1. The area of convergence is determined by tracing the long axis of well-defined bloodstains (preferably drops traveling in an upward direction) within the pattern back to a common area or source. The area of convergence is a two-dimensional representation.
 - a. Using strings or graphic tape, extend the strings through the long axis of the individual bloodstains. Do not tape over the actual bloodstains but under them.
 - b. Determine the point or area where the strings from each of the bloodstains converge.
 - c. Take measurements to locate the area of convergence in three dimensional space relative to a known location.

5.4 Point or Area of Origin

1. An area of origin is used in tracing the origin of a bloodstain or series of bloodstains back to location that produced the bloodstain, i.e., where it originated.
 - a. Project the impact angles of well-defined bloodstains back to an axis constructed through the area of convergence.
 - b. Using strings projected from each measured bloodstain at its angle of impact, trace them back to an axis perpendicular to the plane on which the bloodstains are located. These should pass through their area of convergence. A tripod can be used to tape the string at the area of origin.
 - c. The determined area of origin could represent the height above a floor or the distance from a wall, ceiling or other object, to the source of the blood or impact site.
 - d. Conclusions regarding area of origin:
 - Include a range of possible impact sites.
 - Consider a range of possible flight paths that might produce a similar angle of impact.
- Remember that shorter travel distances and higher energies creating blood droplets tend to produce straighter lines of trajectory.

5.5 Actions Producing Stains (based on visual pattern produced)

1. Depending on the size, shape and distribution of blood spatter and bloodstains found at the crime scene, the analyst may be able to characterize them as low energy, medium energy, or high energy or some combination.
2. These stains may also be characterized as representing typical bloodstain patterns produced by such things as cast-off, transfers/contact pattern stains, swipes, wipes, drips, trails, expired blood, arterial spurting and impression type patterns.
3. The definition of the terminology used in describing blood patterns should be included in the case file for each case. The recommended terminology changes over time and it is a good practice to include the definitions used at the time the interpretation was done. One way to accomplish this is to include the current terminology list (at the end of this procedure) in the notes. A second way is to include a written definition of the term after the term is used in the text of the report.

5.6 Absence of Blood

1. The lack of blood at a scene or voids present at scene should also be noted.
 - a. The lack of blood may indicate that this is not the original scene and the victim was not injured here, but that this is possibly a dumping ground.
 - b. The absence due to a void area in a pattern may indicate the presence of an object during the event or an intervening object (such as a person) that has since been removed from the scene.
 - c. The presence of clothing may also prevent or restrict blood from being deposited within the scene.

5.7 Direction of Flow

1. The direction of flow should be with gravity. If the flow is in a different direction or changes direction this denotes movement or another force acting upon the stain (such as wind) and should be carefully documented prior to movement of the person/ item.

5.8 Deposition of Blood on Clothing

1. In addition to the normal concerns related to bloodstain interpretation, clothing presents challenges based on folds in the cloth, relocation of stains when the clothing is removed, and deposition of new stains when a body is moved. Examination of the earliest photographs may help in determining what has been altered.
2. Examination of clothing includes determination of which side of the clothing the stain originated from. This is determined based on observations related to the intensity of the stain on each surface, the wicking of the fabric, and the microscopic appearance of individual yarns/ fibers.
3. Fabrics may have a treatment on the surface, such as a water resistant application, that may also present challenges in the interpretation of the stains.

5.9 Experimentation

Experimentation allows the bloodstain pattern analyst to recreate mechanisms known or suspected to have occurred at a scene in order to determine what bloodstain patterns, if any, these mechanisms can create. Experimentation allows a thorough evaluation of these mechanisms in a controlled environment.

When performing bloodstain experimentation, it is important that the analyst prepare a scientifically sound experimental design. The experiment should be designed in a manner to mirror the mechanisms at the scene as closely as possible. This includes obtaining similar weapons, ammunition, clothing, carpet, etc. The design of the experiments, as well as the resultant bloodstains, should be thoroughly documented through written descriptions and photographs. Sketches and diagrams may also be used to document the results of the experiment. The relevant documentation from the experiments will be included in the notes for that case. If the results of the experimentation are used to form a conclusion in the interpretation of the patterns, a statement must be included in the report stating that the experiments were performed.

The goal of experimentation is to reproduce as much as possible bloodstains present at the scene as well as on submitted evidence. Analysts should consider all possibilities and may need to perform a number of experiments to include or exclude specific mechanisms.

6.1 References

- A. Trace Analysis- Bloodstain Pattern SOP, Version 1.1 October 2002 from Colorado Bureau of Investigation (CBI)
- B. Eckert, William G. and Stuart h. James, Interpretation of Bloodstain Evidence At Crime Scenes, Elsevier Science Publishing, New York, 1989
- C. James Stuart H. (editor), Scientific and Legal Applications of Bloodstain Pattern Interpretation, CRC Press, 1999, plate 1.
- D. Rynearson, Joseph - Evidence and Crime Scene Reconstruction A Guide for Field Investigations, 6¹ Edition April 2002
- E Gardner, Ross M., Practical Crime Scene Processing and Investigation, CRC Press, 2005 pp. 135 to 152.

SWGSTAIN 2009 Recommended Terminology

Accompanying Drop - A small blood drop produced as a by-product of drop formation. Altered

Stain - A bloodstain with characteristics that indicate a physical change has occurred.

Angle of Impact- The acute angle (alpha), relative to the plane of a target, at which a blood drop strikes the target.

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

Area of Origin - The three-dimensional location from which spatter originated.

Back spatter Pattern - A bloodstain pattern resulting from blood drops that traveled in the opposite direction of the external force applied; associated with an entrance wound created by a projectile.

Blood clot- A gelatinous mass formed by a complex mechanism involving red blood cells, fibrinogen, platelets, and other clotting factors.

Bloodstain- A deposit of blood on a surface.

Bloodstain pattern - A grouping or distribution of bloodstains that indicates through regular or repetitive form, order, or arrangement the manner in which the pattern was deposited.

Bubble Ring- An outline within a bloodstain resulting from air in the blood.

Cast-off Pattern -A bloodstain pattern resulting from blood drops released from an object due to its motion. Cessation

Cast-off Pattern- A bloodstain pattern resulting from blood drops released from an object due to its rapid deceleration.

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

Directional Angle - The angle (gamma) between the long axis of a spatter stain and a defined reference line on the target.

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

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.

Edge Characteristic- A physical feature of the periphery of a bloodstain.

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

Flow Pattern -A bloodstain pattern resulting from the movement of a volume of blood on a surface due to gravity or movement of the target.

Forward Spatter Pattern- A bloodstain pattern resulting from blood drops that traveled in the same direction as the impact force.

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

Insect Stain- A bloodstain resulting from insect activity.

Mist Pattern - A bloodstain pattern resulting from blood reduced to a spray of micro-drops as a result of the force applied.

Parent Stain- A bloodstain from which a satellite stain originated.

Perimeter Stain- An altered stain that consists of the peripheral characteristics of the original stain.

Pool -A bloodstain resulting from an accumulation of liquid blood on a surface.

Projected Pattern - A bloodstain pattern resulting from the ejection of a volume of blood under pressure.

Satellite Stain - A smaller bloodstain that originated during the formation of the parent stain as a result of blood impacting a surface.

Saturation Stain- A bloodstain resulting from the accumulation of liquid blood in an absorbent material. Serum

Stain-The stain resulting from the liquid portion of blood (serum) that separates during coagulation.

Spatter Stain- A bloodstain resulting from a blood drop dispersed through the air due to an external force applied to a source of liquid blood.

Splash Pattern - A bloodstain pattern resulting from a volume of liquid blood that falls or spills onto a surface.

Swipe Pattern - A bloodstain pattern resulting from the transfer of blood from a blood-bearing surface onto another surface, with characteristics that indicate relative motion between the two surfaces.

Target- A surface onto which blood has been deposited.

Transfer Stain - A bloodstain resulting from contact between a blood-bearing surface and another surface.

Void - An absence of blood in an otherwise continuous bloodstain or bloodstain pattern.

Wipe Pattern -An altered bloodstain pattern resulting from an object moving through a preexisting wet bloodstain.

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