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2009 I.A.B.P.A. Officers

PRESIDENT

Iris Dalley
scsairis@hotmail.com

Vice President, Region I
Carolyn Gannett
carolyn.gannett@sdsheriff.org

Vice President, Region II
John Forsythe-Erman
jon.forsythe@rcmp-grc.gc.ca

Vice President, Region III
Todd A. Thorne
tat23@kenoshapolicе.com

Vice President, Region IV
Craig Stewart
craig.stewart@jus.gov.on.ca

Vice President, Region V
Andre Hendrix
andre.hendrix@zeeland.politie.nl

Vice President, Region VI
Mark Reynolds
mark.reynolds@police.wa.gov.au

Secretary / Treasurer
Norman Reeves
norman@bloody1.com

Sergeant at Arms
Jeff Scozzafava
jscozz@hotmail.com

Immediate Past President
LeeAnn Singley
copsci2@msn.com

Historian
Herbert Leon MacDonell
forensiclab@stny.rr.com
President’s Message

As I write my first message to you as President, I first thank you all for allowing me to serve in this office. It is my sincere hope that as we go forward that I will not disappoint the trust that you have given me. President LeeAnn Singley did a superb job and continues to serve and support the IABPA as our Immediate Past President. I greatly appreciate her example and assistance.

We welcome several new Board Members. Region I Vice-President Carolyn Gannett is from San Diego, California. Carolyn did most of the work on the bylaws revisions last year. Region III Vice-President Todd Thorne is from Kenosha, Wisconsin. Todd is an associate editor of the IABPA NEWS. Sergeant-at-Arms Jeff Scozzafava is from New Jersey. Jeff has offered to host the 2010 Conference in Atlantic City, New Jersey. Each of these individuals has shown dedication and support to this Association by their active participation in the conferences and their willingness to assist others and promote the mission of the IABPA.

Pam Bordner is working on preparations for the 2009 Training Conference in Portland, Oregon. Information is posted on the website and this issue of the NEWS. I encourage everyone to be making plans to attend that conference. It’s not too early to get those reservations in! If you wish to present a paper or workshop or the help in some other way, please contact Pam. Her information is on our website and in the NEWS.

In 1992, I attended my first IABPA Training Conference in Colorado Springs, Colorado. I was in awe of the people making the presentations, in awe of the depth of research and the detail of case investigations. I wished that I had the fortitude to someday stand up there in front of that auspicious group. I knew, of course, that I could never do that! Sitting in the back of that conference room, I was quietly shaking in my boots! Will wonders never cease? With constant training and encouragement I received from other IABPA members, I was convinced to make my first presentation. I was still shaking, but I got through it. The rest is history, and now I am writing as your President, hoping that someday I can be as worthy as those who have served before me and with me. I sit in this office today because of those members who were fulfilling the mission of the IABPA.

Gratefully,

Iris Dalley
Newly Elected Officers for 2009

President
Iris Dalley

Iris Dalley recently retired as the Crime Scene Agent for the Oklahoma State Bureau of Investigation’s Eastern Regional Office. She began her career with the OSBI in 1989 as a Criminalist working in Forensic Serology and Crime Scene Processing/Reconstruction. She advanced through the Criminalistics Division of the OSBI to become the Supervisor of the OSBI Eastern Regional Biology Laboratory, before transferring to the OSBI Investigative Division to become one of the first designated Crime Scene Agents. Dalley is currently a partner in the forensic education and consulting company, Bevel, Gardner, and Associates.

Dalley has a Bachelor of Science/Biology and a Master of Secondary Sciences. She has attended over 2000 hours of law enforcement/forensic training, including academies with the Oklahoma Council on Law Enforcement Education and Training, the Oklahoma State Bureau of Investigation, and the Southern Police Institute/Homicide Investigations. She received training in Bloodstain Pattern Analysis from the OSBI, the Oklahoma City Police Department, the Kansas Bureau of Investigation, and Henderson Forensics in Texas.

Dalley holds an Advanced Law Enforcement Certificate for the State of Oklahoma, and Instructor Certificate. She has taught courses in Evidence Collection and Preservation, Preliminary Investigations, Crime Scene Documentation, Crime Scene Investigations, Crime Scene Reconstruction, Reconstruction Animations, Preparing Demonstrative Exhibits, Sexual Assault Investigation, and Introduction to Bloodstain Pattern Analysis. She holds IAI certification as a Senior Crime Scene Analyst.

Dalley has served as Secretary of the Association for Crime Scene Reconstruction, as Regional Vice-President of the International Association of Bloodstain Pattern Analysts, as member of the International Association of Identification Subcommittee on Bloodstain Pattern Analysis, and as vice-president of the Oklahoma Division of the International Association of Identification. She has done presentations for each of those organizations in their annual training seminars, and has instructed municipal, state, tribal, and federal law enforcement officers in crime scene investigations.

Dalley has been court-qualified in the U.S. District Courts in Oklahoma and Texas, in Oklahoma District Courts, and in District Court in Idaho as an expert in Forensic Serology, Crime Scene Investigation and Reconstruction, Trajectory Analysis, and Blood Stain Pattern Analysis. She is a member of the Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN).
Carolyn Gannett is a Criminalist III with the San Diego County Sheriff’s Crime Laboratory in San Diego, California as well the Laboratory Professional Development manager and Safety Manager. She is qualified in bloodstain pattern analysis and crime scene investigation as well as controlled substance and alcohol analysis and gunshot residue analysis by SEM/EDX.

She received Bachelor of Science degrees with honors in Chemistry and Russian Language and Literature from the University of Iowa in Iowa City, Iowa and a Master of Science Degree in Chemistry with Specialization in Nuclear Chemistry from the University of California in Berkeley, California.

Carolyn is a member of the International Association of Identification, the Association for Crime Scene Reconstruction and the Rocky Mountain Association of Bloodstain Pattern Analysts. Additionally, she is a member of the California Association of Criminalists where she has served as President and member of the Board of Directors. She has been a member of the International Association of Bloodstain Pattern Analysts since 2002.

Carolyn has conducted training in Bloodstain Pattern Analysis at the San Diego County Sheriff’s Crime Laboratory and the Oceanside, California Police Department as well as for the deputy district attorneys and public defenders in San Diego County. In 2008, she was a presenter and panelist at the Midwest Forensic Research Center’s Bloodstain Pattern Analysis Symposium on Ethics and Bloodstain Pattern Analysis in Ames, Iowa. She has been an invited guest at SWGSTAIN in 2003, 2006 and 2008.
Todd A. Thorne is currently working in both the law enforcement as a crime scene investigator with the Kenosha, Wisconsin Police Department and private consultations. Todd is well versed in Bloodstain Pattern Analysis, Forensic Photography, Evidence Processing Techniques as well as Crime Scene Reconstruction. He is also a Latent Fingerprint Examiner. Todd has a variety of published articles and photographs in these disciplines. Todd has been working in the field of criminalistics for over 20 years and has offered expert testimony/consultation in numerous cases. He is a certified State of Wisconsin and Illinois Instructor and is on staff with the Nebraska School of Forensic Science. Todd is a sought after speaker and is an adjunct instructor in the area of Forensic Science for several colleges throughout the country. In addition, he has served on Wisconsin's Domestic Violence/Sexual Assault Evidence Training Team. Todd has been a member of the Federal Government's U.S. Department of Homeland Security, serving with the DMORT V Disaster Response Unit. He operates Todd A. Thorne & Associates Forensic Consultants and Photography Services, LLC, which has exposed him to both national and international cases. Todd instructs throughout the country for The Lynn Peavey Company and has been called upon for technical consultation/research by various entities.

Todd has served the Wisconsin Association for Identification as President, Chairman of the Board and has chaired numerous committees, currently The International Association of Bloodstain Pattern Analysis as Region 3 Vice President, Associate Editor and The Kenosha Professional Police Association as the secretary. Todd's hobbies include family activities, church activities, camping and photography. He is married with 5 children.
Jeff Scozzafava
Sergeant at Arms

Jeff Scozzafava is currently Detective in the Somerset County Prosecutor’s Office in Somerville, New Jersey and assigned to the Criminal Investigations Division, Forensics Unit as well as the Arson Task Force and the Dive-Rescue Team.

Jeff was employed as a Trooper in the New Jersey State Police for over 20 years. Half of his State Police career was as uniformed patrol and response, and the remainder as Detective in the State Police Crime Scene Investigation Unit. Jeff retired in July 2007 as a Detective Sergeant. He has processed more than one thousand crime scenes involving cases of homicide, police involved shooting and use of deadly force, suicide, accidental death, suspicious/unattended death, arson, aggravated assault, aggravated sexual assault and sexual assault, robbery, burglary and theft, auto theft and recovered stolen property, fraud, narcotics and weapons, child abuse and domestic violence, international and domestic terrorism, fatal/serious motor vehicle and boating accidents.

He has conducted hundreds of bloodstain pattern analysis investigations and has conducted thousands of friction ridge comparison examinations, making hundreds of fingerprint and palm print identifications.

Jeff is Instructor certified through the New Jersey Division of Criminal Justice, Police Training Commission. Jeff has provided instruction regarding crime scene investigation, bloodstain pattern analysis and fingerprint comparison for the New Jersey State Police, United States Department of Justice and the Somerset County Prosecutor's Office. He has testified numerous times in various New Jersey Superior Courts as an expert witness in the area of bloodstain pattern analysis, crime scene investigation and fingerprint comparison and identification.

He has completed basic and advanced bloodstain pattern analysis training and has also received crime scene investigation training regarding film and digital photography, evidence identification and collection, crime scene reconstruction, latent print processing and comparison, arson investigation and homicide investigation. He has been a member of the International Association of Bloodstain Pattern Analysts since 2002.

RESEARCH ARTICLE
The Identification and Significance of Hemospheres in Crime Scene Investigation

James O. Pex, M.S., D-ABC
Pex Forensic Consulting, Inc.
North Bend, Oregon

Abstract

The collection of microscopic evidence at a crime scene has been common for many years. The collection techniques involve use of enhanced visual examination, adhesive lifts and vacuum sweeping with a filter capture system. Identification of hemospheres may add confirmation of blood to non-specific patterns observed in Luminol testing. For purposes of this paper, hemospheres are defined as extremely small, sub-millimeter droplets of blood. The observation, collection, and relevance of hemospheres at a scene are reviewed.

Introduction

In 1769, a plumber named William Watts poured molten lead through a screen and captured the resulting lead pellets in water. Current techniques for shotshell pellets have not changed much over the years (1). The usual height required for lead to form uniform round pellets is 133 to 200 feet. The size of the pellets was controlled by the size of the holes in the screen. The conversion of liquids to a solid by falling in air has been well established.

Several times over the last decade, microscopic examination of crime scene evidence has demonstrated bloodstain formation from spheres to flat rings. Experiments conducted during training courses to demonstrate these shapes utilized an electric motor with a wood paddle attached. Liquid blood was dropped on the rotating paddle and small drops of blood were created. Larger drops traveled greater distances than smaller drops. These drops of one millimeter or less in size dried almost immediately upon impact with a surface. If the surface was absorbent and close to the motor, the characteristic ring formation was noted. If Mylar® was substituted for the non-absorbent impact surface, various shapes would be noted (2). Some drops dried before becoming a flat ring and demonstrated a volcano-like shape. As noted in other blood drying time tests, the center is always last to dehydrate.

In a homicide investigation in the late 1980s, nearly spheroid drops of blood less than one millimeter in diameter were removed from a velour shirt utilizing the standard scraping technique onto white paper. The sizes of these drops ranged from 0.1 to 0.5 mm in diameter. Scanning electron microscopy (SEM) along with micro Kastle-Meyer testing confirmed these were blood. In the examination of this shirt, impact spatter was re-created experimentally with the discharge of a firearm and the results were evaluated. The bloodstains of interest were extremely small and spherical.
Experimentation

A bullet trap was placed on a work table with the center 42 inches above the floor. A 2’ x2’ swatch of new carpet was placed on the floor directly below the bullet trap. A control swatch of carpet was vacuumed and sprayed with Luminol prior to firearms testing.

Human blood, preserved in EDTA, was used to saturate a sponge. The sponge was placed inside a tight-fitting plastic bag and attached to the front of a bullet trap. A .38 Special revolver was fired with the muzzle in loose contact with the sponge. The testing took place indoors at a temperature of 71 degrees Fahrenheit. Backspatter was noted on the weapon, the firing hand and the shirt sleeve of the forearm. The carpet was visually examined, and vacuumed with a 3M brand model C-1000 Trace Evidence Vacuum. The vacuumed material was collected in C-1010 Microfilters.

A second test was performed on another segment of new carpet and retained for thirty days. The carpet was exposed to light foot traffic prior to vacuuming. The filters were examined with a 7X to 45X microscope. Luminol testing was performed after the vacuum collection (Figure 1). The carpet was re-examined for any residual bloodspatter.

A third test was performed to determine the solubility of hemispheres by placing several in a small quantity of water. Observations were made over a three hour period.

Figure 1. Positive Luminol reaction on carpet.

Method for the Presumptive Testing of Microscopic Impact Spatter

The detection and subsequent chemical testing on sub-millimeter amounts of blood has been problematic in the past due to the limited sample available. The transfer of the blood particles to a stable media, then performance of a test that is sufficiently sensitive to provide a visual response can be achieved by the following method:
Reagent preparation of Leucomalachite Green (LMG)

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Perborate</td>
<td>3.2 g</td>
</tr>
<tr>
<td>Leucomalachite Green</td>
<td>0.1 g</td>
</tr>
<tr>
<td>Glacial Acetic Acid</td>
<td>66 mL</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>33 mL</td>
</tr>
</tbody>
</table>

Procedure

1. Apply a thin film of clean paraffin to the surface of a glass slide.
2. Prepare positive and negative control slides.
3. Utilizing a fine tip probe, pick up minute stains with the aid of a microscope and cluster them in the paraffin.
4. After collection of several minute stains, gently heat the underside of the slide with a match or heating block, just enough to melt the paraffin. Allow to cool and clean the bottom of the slide.
5. Recheck the location of the potential bloodstains with a microscope.
6. Apply a drop of the LMG solution to the test slide and prepared positive and negative control slides.
7. The production of a green color indicates a positive test.

Although the Kastle-Meyer (KM) test is the most common presumptive test for blood, weak pink reactions were difficult to see at the microscopic level. If LMG is not readily available, Hemastix® Reagent Strips used for urinalysis testing can be utilized. Hemastix® is manufactured by Bayer and is available in most pharmacies as well as forensic product companies. Take two strips and dip the patches in 0.5 mL of distilled water for a minute. Apply a drop of the reagent water to the slide and a positive and negative control slide. A green/blue reaction offers a high contrast to the color of the blood and can be observed microscopically on the blood, if present. From a chemist’s perspective, the use of Hemastix® is a bit crude, but efficient.

Presumptive tests can produce false positives with certain substances such as metals, oxidizing agents and peroxidases. If the test is positive, confirmatory testing should be performed if possible.

Results

Examination of the control microfilter did not reveal any hemospheres or blood fragments as expected. Luminol testing did reveal a few nonspecific luminescent areas. Examination of the vacuum sweepings from the two other carpets used in test firings revealed a number of interesting shapes of bloodspatter, all less than one millimeter in diameter (Figure 2). Measurements were made with software associated with an MD 900 five megapixel camera attached to an AmScope 900 Microscope. The measurements were standardized with a National Institute of Standards and Technology (NIST) micro ruler.

Microscopic examination of the post-test carpet revealed the same characteristic shapes of blood spatter often seen on a larger scale. The standard experimental model used to produce various shapes of blood spatter is to use a paddle wheel attached to an electric motor. Blood is dropped on the rotating paddle and spatter is directed to absorbent and non-absorbent
surfaces (3). In addition to the basic shapes, microscopic examination may also demonstrate complete spheres (Figure 2) not seen in macroscopic testing. Figure 3 depicts a common shape of spatter and hemispheres.

In this examination, hemispheres varied in size from 0.5mm to 36μm in diameter. Some spheres were barely visible at the magnification limit of 45x. It is possible that there may be smaller hemispheres that exceed this limit of detection or that passed through the pores of the filter. This study has shown that a single gunshot may produce several hundred hemispheres (Figure 4).

![Figure 2. Three of the larger hemispheres are visible as indicated by the arrows (10x).](image)

![Figure 3a. Hemispheres and impact spatter on carpet fibers (45x).](image)

![Figure 3b. Hemispheres and impact spatter on carpet fibers (45x).](image)
These spheres had limited solubility in water. Hemospheres approximately 100 µm in diameter were chosen and placed in water. They floated on the surface and were reasonably intact for three hours. The samples selected for solubility were approximately the same size as the width of a human hair. No tests were performed to determine maximum solubility times, only to demonstrate that the hemospheres were quite durable. It is possible that the heat from the weapon discharge improves their durability.

Luminol testing on the carpet segments provided a non-specific stellate pattern of illumination. Without vacuuming, it may be difficult to determine the source of the illumination, especially on old carpets and dirty floors. The carpet sprayed with Luminol was allowed to dry and then vacuumed. Impact spatter was visible still attached to carpet fibers after the luminol testing (Figure 5). Many conventional shapes of impact spatter were collected (Figure 6), and hemospheres were again recovered in subsequent microfilters (Figure 7). At higher magnification, many of the hemospheres exhibited a unique dimple (Figure 8). This is an expected phenomenon seen in skeletonized blood spatter as the center of impact spatter always dries last.
Figure 5. Post Luminol examination of carpet with existing blood spatter (10x).

Figure 6. Central impact spatter diameter is 0.3 mm. The arrows indicate two hemispheres at 30x.
Figure 7. Arrows indicate post-Luminol hemospheres close to a human hair at 40x.

Figure 8. The characteristic dimple within the hemosphere is visible at 90x.
Discussion

The reasonable explanation for the appearance of hemospheres is similar to a shot tower. As a spray of spattered blood comes back toward the shooter (4), some droplets travel up high enough to dry prior to reaching the carpet. Some travel down and forms various other shapes depending on the diameter and the time of travel to the impacted surface. The minimum distance from the floor or the minimum caliber required was not determined. However, hemospheres were able to be created with a .22LR pistol contact shot into a blood-soaked sponge.

In this type of testing under controlled circumstances, it is easy to identify the observed spheres as blood. However, in the crime laboratory environment, the issue becomes more complex with a need to confirm these spheres as blood. Their lack of solubility in water affects the testing with most blood screening agents. The quantity of material may require PCR or STR techniques to determine human origin. The size and dispersal of these spheres renders Luminol inconclusive (5). It cannot be determined if a minute spot of light originated from un-dissolved chemicals in the sprayer, unknown substances on a soiled surface, or the blood on the fabric. Metallic fragments were also noted in the carpet that may have originated from the bore of the weapon at the time of discharge.

Dixon, et al. (7) described a technique for blood identification utilizing scanning electron microscopy (SEM). Elemental composition may be a way to support the physical appearance of the spheres in conjunction with presumptive testing. The distribution of these hemospheres still remains a question. EPA documents (6) indicate that particles greater than 50-100 µm usually remain in the air for a few minutes before settling near a surface. Considering that a single intact red blood cell is 7 µm in diameter, a hemosphere is a minute volume of blood. Consequently, these blood particles may remain suspended in air for extended periods of time. Since we do not know the minimum size of hemospheres created, a health issue comes to the forefront in a shooting environment. Studies of GSR have shown that these particles are easily affected by air currents. An open window at a scene could relocate them to other areas.

Hemospheres, the smallest form of impact blood spatter, were detectable on the clothing of a person in the vicinity of a shooting. It is not known, but certainly also possible that these hemospheres may occur with forward spatter or other forms of impact spatter mechanisms. Because these small particulates may remain suspended as in GSR testing, some people may be contaminated but may not have committed the crime.

The decision to vacuum should be a consideration at the crime scene. Hemospheres were found in higher concentrations before the application of any liquid blood detection solutions. However, their durability does not prevent the test from being conducted after the surface had dried. It is recommended that an area such as a room be divided into one yard squares and each square vacuumed, the canister changed and the next area tested. The area with the highest concentration of hemospheres should represent where the shooting took place. Figure 9 is a SEM photograph of a bisected hemosphere. This was removed from a shirt and the placement of the original fiber can be seen at the bottom of the sphere halves. The photograph is also interesting in that the sphere was hollow. Observations of micro blood spatter up to ninety magnifications revealed a variety of shapes and sizes common to those seen with the naked eye. Many of the shapes observed with the microscope would be difficult...
to defend as bloodspatter to the exclusion of all other possibilities. Hemospheres present a unique size and shape that is reproducible.

While examining for hemospheres, fragments of burned gunpowder were seen in the microfilters (Figure 10). The combination of hemospheres and partially burned gunpowder particles could be an important combination when investigating a crime scene and determining the location of a shooting; especially if the body was missing or suspected of having been moved to another location.

It is recommended that the analyst repeat these tests and become familiar with the shapes seen under the microscope. Fragments of larger bloodstains are sometimes seen and easily recognized by their irregular edges.

Figure 9. Hemosphere split in two parts with concave red blood cells (RBCs) visible. The U-shaped fragment below the RBCs is the fiber attachment (SEM).
Conclusion

The identification and documentation of hemospheres offers new evidence for shooting scene reconstruction. Difficulty with current screening tests and confirmation as human blood has to be overcome to realize their full potential. The visual appearance under the microscope may be seen as consistent with hemospheres until confirmation becomes available. Within the vacuum sweepings, these spheres compliment other evidence of firearm discharge such as burned and unburned gun powder particles. This carries the important concept from just the discharge of a firearm to the reality that someone was actually struck by a bullet, if other bloodstains are absent. It is a reasonable expectation that barium, antimony and lead may be found within hemospheres.

Hemospheres have been observed on three occasions in the past. Unfortunately, vacuum sweepings from shooting homicides were normally done only to look for gun powder particles. Not every shooting scene requires this type of examination. It would be of great value for investigators to begin looking for these spheres and to determine their frequency in shooting incidents along with the circumstances in which they occurred.
Unusual Case Circumstance

In the late 1980s, a homicide occurred at a local convenience store. The victim was shot in the back of the head several times while lying on the floor. Suspects were later identified and their clothing submitted to the laboratory for examination. One suspect had a red velour shirt. No blood was visible. Standard scraping of the back of the shirt onto white paper for trace evidence produced small spherical drops of blood. These were approximately 0.1-0.5 mm in diameter. The Kastle-Meyer test was positive on the larger spheres. These were subjected to SEM microscopy and it could be seen that an area of the drop had previously been attached to a fiber. At that time, enzyme phenotyping was not sufficiently sensitive to detect any phenotypes. Inadequate research had been done at the time to appreciate the value of this evidence. Approximately ten years later, the case was reopened. DNA testing was successful on the remaining spheres and showed the blood originated from the victim. Due to their location on the back of the shirt and other facts in the case, it was suspected that this individual may have held the victim down when the victim was shot by another person.

References

Guide to Capturing Photographs of Bloodstains for 3D Measurement

Eugene Liscio, P.Eng.
AI2–3D Forensic Animations
Woodbridge, Ontario, Canada
www.ai2-3d.com

Introduction

When one stops to think how many decades have passed since the camera first became common place in law enforcement agencies, it is quite incredible to think that still today, taking photographs is one of the most common methods of documenting evidence. The evolution of the computer and digital technologies has changed the way photographs are recorded and stored, but they have not lessened the importance of documenting evidence through photography. Although more and more law enforcement agencies are becoming equipped with high tech 3D laser scanners and reflector-less total stations, most people find it surprising to note that it is possible to record accurate 3D coordinate information by using just about any digital camera. The key is in how to take the photographs.

Often, a bloodstain expert is retained, weeks, months or years after a brutal crime has taken place and the key pieces of evidence are provided in the form of police photographs, reports and diagrams. Most bloodstain experts know that without placing a reference set of axes in the camera’s view, it becomes next to impossible to get accurate measurements for key pieces of evidence. Even with a reference set of axes, trying to visualize a specific bloodstain pattern with a high degree of perspective is next to impossible and key details are easily missed.

This guide has been written with the intent of assisting Crime Scene Investigators with capturing photographs of bloodstains (or other evidence) that will preserve 3D geometric data for future analysis by a photogrammetry specialist.

Photogrammetry

Photogrammetry is the science of taking geometric measurements from photographs. “Photogram” is a photograph and “metry” is the science of measuring. Since a photograph takes images from the 3D world and projects it on a flat 2D image plane, we lose the depth information. However, photogrammetry can be viewed as the process by which we do the reverse. By knowing some information about the camera which took the photographs and by having two or more photos of the same object from a different perspective, we can gain some 3D information back.

This is normally accomplished by taking several photographs of a particular piece of evidence from wide angles of separation and by recording a reference dimension. Once this is done a subsequent analysis can be sent to a photogrammetry specialist to solve for:

1. The focal length of the camera being used to take the photographs.
2. The position of the camera in 3D space.
3. The camera’s orientation in 3D space.
4. 3D Measurements for specific points that appear in at least 2 or more photographs.
5. 2D measurements for specific points that appear on flat surfaces.

It is not necessary to record the camera’s position or focal length since these will be solved through the photogrammetry analysis. However, in practice, it is beneficial to know these values since they provide a “ballpark” verification of the solution.

**Focal Length**

The focal length of a camera is the distance between the imaging plane (which is the digital sensor on a digital camera or the negative in a film camera) and the point where all the light rays intersect (i.e. optical centre). The optical center of a lens is a point, usually within a lens, at which all the light rays entering the camera cross (Figure 1).

![Figure 1. Focal length is the distance from the imaging plane to the principal point (or optical center) in the lens.](image)

The focal length of a camera can also be considered, in simple terms, as the amount of zoom/magnification that was used to take a photo. The focal length changes when someone zooms in and out to capture an image. The minimum and maximum focal length is called the focal range and for most digital cameras made today, you will usually find this range inscribed around the front of the lens.

**Camera Position and Orientation**

The camera’s position in 3D space is defined as the x, y and z coordinates where it is located from an object in the photograph and its orientation is simply how the camera is “angled” or rotated about each of the x, y and z axes (Figure 2).
Lens Distortions

Distortion is one of the more easily seen deformations in a photographic image because horizontal and straight lines appear to be curved. This distortion is often used as an artistic technique in photography (i.e. fisheye lens); however, in photogrammetry it is always an undesirable anomaly that requires correction.

There are two types of distortion often referred to as “barrel” and “pincushion” distortion. Barrel distortion is associated with a wide angle or a “fisheye” lens and has the straight lines in the horizontal and vertical direction bulging outwards just like a “wine barrel” (Figure 3). Pincushion distortion is associated with a zoom or telephoto lens and has straight lines bending inwards (Figure 4).
Another type of lens distortion is called de-centering. In the examples shown above, both barrel distortion and pincushion distortion are shown such that the geometric centre of the image has no distortion. (i.e. all lens distortions are about the centre of the image and there is no distortion at the center itself). However, due to very slight imperfections in lens alignment, the lens distortion is “de-centered” about another point which is at a specified distance and angle away from the geometric center of the image.

The effect of all these lens distortions is that they degrade the accuracy of measurements. Fortunately, the process of correcting for lens distortion is often automated by the photogrammetry software. Camera’s can be calibrated either before or after taking the photos as long as the same settings (i.e. focal length) are used during the calibration. Knowing the effect the camera has on the images captured (i.e. understanding a camera’s distortion) allows for accurate measurements to be taken during the photogrammetric analysis.

**Guidelines for Taking Photographs**

1. Use only one setting for your camera zoom and do not change or adjust it between photos. The camera zoom setting needs to be left at one setting when taking photos so that the same focal length is used for all photos. For this reason, it is often best to use the widest angle on the camera and move in close to the evidence. Ensure that you check frequently that the setting has not changed. People often have a habit of “playing” with the zoom setting and it may take some getting used to. The zoom setting can be changed for any set of photos, but if you are focusing on documenting one piece of evidence, use the same zoom setting!

2. Ensure that the object takes up a good portion of the photograph (Figure 5.) Having your object close to the camera or taking up as much of the photo as possible means you get greater accuracy in the end. Remember that in any digital camera, there is a limit to the pixel width and height on the image sensor so make sure the evidence takes up a good percentage of the image. You need to see the evidence in order for it to be accurately measured and to bring out fine details.
3. Capture images at a high resolution. As mentioned above, the size/resolution of an image will influence the accuracy you will get for any measurements. The higher the resolution and less pixilated an image is when reviewing the images, the more likely you will be able to identify and measure smaller targets or points of interest (Figure 6). With the relatively low cost of memory for digital cameras, resolution and storage should not be an issue.

4. Optimum Angles Between Images. Ninety degrees is the optimum angle between photos, but angles greater than thirty degrees should be the goal when taking images. Changing vertical heights also increases the overall angle so it is not necessary to always go “around” the object (Figure 7). Do not take photos of the object standing more or less the same position and do not adjust the zoom!
5. Use the Ring Method to take photos of any objects. The ring method is nothing more than taking photos around an object in a circular fashion and in regular intervals of 90 degrees or less (Figure 8). Normally, if one were to take 12 photos around a bloodstain located on the ground, then one would divide the spaces evenly (about 30 degrees). This ensures there is good overlap of photos. For areas of particular importance take a minimum of 3 photos from different angles.

6. Mark a minimum of 7 visible targets on important areas. Where possible, it is best to include a minimum of 7 targets around the evidence of interest. The greater the number of targets that can be marked and referenced between the set of photos, the more accurate the results should be. The best targets are high contrast (e.g. black car with white target dots). Targets can be as simple as printing out a set of black circular dots on white paper and placing them around the bloodstained area (Figure 9). Also,
most business supply stores sell colored sticker dots that work equally well. Ensure that the dots are of high contrast to their background.

Figure 9. Targets can be placed anywhere around a bloodstain. High contrast targets are best.

7. Try to reference your object relative to other background objects in the photo. Include common features that can be identified in several photos. Poles, signs, buildings, doors, road markings or any other visible objects are useful (Figure 10). In the absence of having targets, look for objects which have some easily discernable points and are visible in each of the photos like sharp corners or intersecting edges. (e.g. Bolt heads, corners of doors, building, etc.)

Figure 10. When targets are unavailable it is especially important to use objects in the surrounding vicinity as references. Note: The above images also include the edges and corners of the wall and doors. These can be used in place of targets for referencing between photographs.

8. Obtain reference measurements. Photogrammetry deals with relative positions and pixel based measurements which means, it is effectively “unitless” until some known dimension or reference is given to bring the solution to scale. Therefore, whenever possible, measure the distance between specific points in your photos for reference.
(Figure 11). Try to gather measurements over larger areas. Do not try to measure small items in the photograph! Also, try to gather several measurements in different directions. These can all be used to verify the accuracy of the photogrammetry analysis in the future.

By taking a few extra photos with photogrammetry in mind, bloodstain measurements are effectively captured and stored to be recalled at any time in the future. Digital photographs are cheap and can still provide accurate measurements years after an accident has occurred. The value of the photos is increased significantly, especially when the outcome of a trial depends on the information contained in the images.

References

An Expiratory Bloodstain Pattern Due to Medical Intervention
Peter Lamb and Gillian Leak
Forensic Science Services
England, UK

A woman was assaulted by a man and sustained multiple stab wounds of the anterior chest as well as a severed lower lip and incised wound of her chin. This wound was possibly caused by a downward thrust of the knife that cut the lip inside her mouth (Figure 1).

Figure 1. View of incised wound of lower lip and chin and two of the upper chest stabs wounds of victim.

The woman was alive when the paramedics attended the scene and they attempted resuscitation using an Ambu® mask to administer oxygen while she was on the floor near a wall of the residence. She was then transported from the scene and died on the way to the hospital.

Examination of the scene revealed an aerosol-type stain pattern on the skirting board of a wall close to where the victim was receiving medical intervention. The pattern consisted of a dense area of near circular sub-millimeter size stains. The lower portion of the pattern exhibited numerous larger stains in a size range of 1-3 millimeters. Stains close to the floor exhibited a downward directionality (Figure 2).

It was concluded that this was an expiratory bloodstain pattern as the result of paramedic intervention. It was reasoned that the Ambu® mask did not entirely cover the wound on the lower lip so that when the oxygen was forced by pressure into the mask some of it was expelled through the severed lip. As the wound was still bleeding, there was a reservoir of blood available to be acted upon by the increased pressure and was forced through a small non-rigid aperture causing the aerosol-type stain pattern.

There was no involvement of a firearm. This was an interesting stain pattern and without information from the hospital would have been difficult to resolve. The Ambu® mask is standard equipment for paramedics as well as for hospital patient respiratory care. It contains a silicon seal that allows for positive pressure delivery of oxygen to patients (Figure 3).
Figure 2. View of aerosol-type bloodstain pattern on skirting board of wall.

Figure 3. View of bloodstained Ambu® mask used on victim at the scene.
ABSTRACTS OF RECENT BPA RELATED ARTICLES PUBLISHED IN THE SCIENTIFIC LITERATURE


Abstract:

Shoeprints in blood deteriorate over time, even in indoor or sheltered environments. Of the reagents tested, ninhydrin was the best reagent for treating aged impressions on paper substrates. On wooden and linoleum substrates, amido black was the best of the reagents tested.


Abstract:

This stabbing case illustrates the usefulness of Bluestar® Forensic Latent Detection Reagent for the detection of latent bloodstain evidence.


Abstract:

It is common in forensic casework to encounter situations where the suspect has set a fire to cover up or destroy possible evidence. While bloodstain pattern interpretation, chemical enhancement of blood, and recovery of deoxyribonucleic acid from bloodstains is well documented in the literature, very little information is known about the effects of heat or fire on these types of examinations. In this study, a variety of known types of bloodstain patterns were created in a four-room structure containing typical household objects and furnishings. The structure was allowed to burn to flashover and then it was extinguished by firefighters using water. Once the structure cooled over night, the interior was examined using a bright light. The bloodstains were evaluated to see if the heat or fire had caused any changes to the patterns that would inhibit interpretation. Bloodstain patterns remained visible and intact inside the structure and on furnishings unless the surface that held the blood was totally burned away. Additionally, a variety of chemical techniques were utilized to better visualize the patterns and determine the possible presence of blood after the fire. The soot from the fire formed a physical barrier that initially interfered with the chemical enhancement of blood. However, when the soot was removed, using water or alcohol, the chemicals used, fluorescein, luminol, Bluestar®, and Hemastix®, performed adequately in most of the tests. Prior to DNA testing, the combined phenolphthalein/tetramethyl benzidine presumptive test for blood was conducted in the laboratory on samples recovered from the structure in an effort to access the effectiveness of using this type of testing as a screening tool. Test results demonstrated that reliance on obtaining a positive presumptive test for blood before proceeding with DNA analysis could result in the failure to obtain useful typing results. Finally, two DNA recovery methods (swabbing the stain plus cutting or scraping the stain) were attempted to evaluate their performance in recovering samples in an arson investigation. Recovery of DNA was more successful in some instances with the swabbing method, and in other instances with the cutting/scraping method. Therefore, it is recommended that both methods be used. For the most part, the recovered DNA seemed to be unaffected by the heat, until the temperature was 800° or greater. At this temperature, no DNA profiles were obtained.
The 2009 IABPA Training Conference will be held at the Embassy Suites-Portland Washington Square located southwest of downtown Portland, Oregon. The hotel offers complimentary made-to-order breakfast and an evening Managers reception with complimentary beverages and light appetizers. All rooms are suites with a refrigerator, microwave and coffee maker. Wireless internet service is available throughout the hotel for a fee.

The conference rate of $98 US per night plus tax has been established for the block of rooms that we have secured. This rate will be offered from October 2nd-12th for those who wish to arrive early or stay longer based upon room availability. The following link will take you directly to the IABPA reservation page for the Embassy Suites-Portland Washington Square:


The closest airport is the Portland International Airport (PDX) which is located east of downtown Portland and is about 35 minutes from the hotel. Additional information will be provided regarding transportation via the MAX Light Rail, shuttle and taxi. Parking at the hotel is complimentary. Information regarding registration, presentations, workshops and area activities will be provided as it becomes available.

Hosted by the Oregon State Police Forensic Services Division.

Contact:

Pam Bordner
OSP Forensic Laboratory
63319 Jamison Street
Bend, Oregon 97701
Tel: 541-388-6150
E-mail: pam.bordner@state.or.us (Please include IABPA on the subject line)
Organizational Notices

Moving Soon?

All changes of mailing address need to be supplied to our Secretary Norman Reeves. Each quarter Norman forwards completed address labels for those who are members. Do not send change of address information to the NEWS Editor. E-mail your new address to Norman Reeves at:

norman@bloody1.com
Norman Reeves
I.A.B.P.A.
12139 E. Makohoh Trail
Tucson, Arizona 85749-8179
Fax: 520-760-5590

Membership Applications / Request for Promotion

Applications for membership as well as for promotion are available on the IABPA website:
IABPA Website: http://www.iabpa.org

The fees for application of membership and yearly dues are $40.00 US each. If you have not received a dues invoice for 2009 please contact Norman Reeves. Apparently, non US credit cards are charging a fee above and beyond the $ 40.00 membership/application fee. Your credit card is charged only $40.00 US by the IABPA. Any additional fees are imposed by the credit card companies.

IABPA now accepts the following credit cards:

Discover Mastercard
American Express Visa
Training Opportunities

April 20-24, 2009

Basic Bloodstain Pattern Analysis Course
Blutspureninstitute
Usingen, Germany

Instructors: Dr. Silke Brodbeck and Martin Eversdjik
Contact: Dr. Silke Brodbeck
Tel: +49-170-84 84 248
Fax: +49-6081-14879

May 11-15, 2009

Advanced Bloodstain Pattern Analysis and Expert Witness Workshop
Miami, Florida

Presented by the Specialized Training Unit at the Metropolitan Police Institute of the Miami-Dade Police Department
Doral, Florida

Contact: Toby L. Wolson, M.S., F-ABC
Miami-Dade Police Department
Crime Laboratory Bureau
9105 NW 25th Street
Doral, Florida 33172
Voice: 305-471-3041
Fax: 305-471-2052
E-mail: Twolson@mdpd.com

May 25-29, 2009

Math and Physics for Bloodstain Analysis Course
Ontario Police College
Alymer, Ontario, Canada

Course Coordinator: Brian Allen
E-mail: Brian.Allen@ontario.ca
Further information: http://www.opconline.ca

June 1-5, 2009

Bloodstain Evidence Institute
Corning, New York

Contact: Professor Herbert Leon MacDonell
Director
Laboratory of Forensic Science
Post Office Box 1111
Corning, New York 14830
Tel: 607-962-6581
E-mail: forensiclab@stny.rr.com

June 8-12, 2009

Basic Bloodstain Pattern Analysis Course
Elmira College
Elmira, New York

Contact: Paul Erwin Kish
Forensic Consultant & Associates
P.O. Box 814
Corning, New York 14830
Tel: 607-962-8092
E-mail: paulkish@stny.rr.com

June 15-19, 2009

Advanced Bloodstain Pattern Analysis Course
Elmira College
Elmira, New York

Instructors: Paul Erwin Kish and Stuart James
Contact: Paul Erwin Kish
Forensic Consultant & Associates
P.O. Box 814
Corning, New York 14830
Tel: 607-962-8092
E-mail: paulkish@stny.rr.com

July 13-17, 2009

Advanced Bloodstain Pattern Analysis Course
London, England

Instructors: Paul E. Kish and Stuart H. James
Contact:
Anthony Larkin
E-mail: anthony.larkin@met.police.uk

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August 31-September 4, 2009

Advanced Bloodstain Pattern Analysis Course
Ontario Police College
Alymer, Ontario, Canada

Course Coordinator: Brian Allen
E-mail: Brian.Allen@ontario.ca
Further information: http://www.opconline.ca

September 21-25, 2009

Bloodstain Evidence Institute
Corning, New York

Contact: Professor Herbert Leon MacDonell
Director
Laboratory of Forensic Science
Post Office Box 1111
Corning, New York 14830
Tel: 607-962-6581
E-mail: forensiclab@stny.rr.com

*Training Announcements for the issue of the June 2009*
*IABPA News must be received before May 15th, 2009*
Editor’s Corner

This issue introduces the membership to our newly elected officers for 2009 with their photograph and short bio. On behalf of the membership, I welcome our new President, Iris Dalley, Vice president of Region I, Carolyn Gannett, Vice president of Region III, Todd A. Thorne and Sergeant at Arms, Jeff Scozzafava.

I am receiving a number of requests for copies of articles that have been published in the IABPA NEWS from college libraries and individuals. Some of the requested articles date back as far as 1989. I was recently informed by our new President, Iris Dalley that an article published in the June 2002 issue of the NEWS, entitled Extreme Temperature Effects on Bloodstain Pattern Analysis authored by Tom Brady, John Tigmo and Grant Graham, Sr. was used in a trial in Texas. It is encouraging that articles published in the NEWS are continuing to be of interest both at the college level and in the courts.

The first announcement of the 2009 IABPA Training Conference is in this issue of the NEWS. Please send in your presentation abstracts and workshop requests to Pam Bordner. I am planning on hosting the Bring Your Own Case session again which is well attended each year. Those presentations should be limited to 15 minutes to allow enough time for all those wishing to discuss an interesting case.

Paul Kish informed me that there was an excellent response to the Research into the Error Rates Associated with Bloodstain Pattern Analysis online survey. This survey was composed of very basic bloodstain patterns for recognition prepared by Breeanna Meneses and Brian J. Gestring of the Forensic Science Program at Cedarcrest College in Allentown, Pennsylvania. The results of that survey will be published in a future issue of the NEWS when they become available.

Finally, I would again encourage the membership to submit research articles and case reports for peer review and publication in the NEWS.

Stuart H. James
Editor
IABPA NEWS

E-mail: jamesforen@aol.com
Past Presidents of the IABPA

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Charles Edel 1985-1987  
Warren R. Darby 1988  
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Tom J. Griffin 1993-1994  
Toby L. Wolson, M.S. 1995-1996  
Daniel V. Christman 1997-1998  
Phyllis T. Rollan 1999-2000  
Daniel Rahn 2001-2002  
Bill Basso 2002-2006

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