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As Editor, I regret to inform the IABPA membership that our President S/Sgt. Dan Rahn passed away on Saturday, June 15, 2002. His death was unexpected and he will be greatly missed by our organization.

Memorial donations may be made to the following organizations on behalf of S/Sgt. Dan Rahn.

STARS Air Ambulance (Edmonton, Alberta)

<http://www.stars.ca/donations/contribute/>

780-447-5492

Heart & Stroke Foundation of Alberta

<http://www.hsf.ab.ca/>

780-451-4545

Dan e-mailed the following President's Message to me on the 11<sup>th</sup> of June 2002.

***President's Message:***

***Well here we are, it's June already, where does the time fly? It must be a sign of getting old when the time goes by so fast. Summer is almost upon us with the warm weather, family outings, camping, travel, cool drinks, and fun in the sun. I hope everyone has a safe and happy summer.***

***The Organization is alive and well and I have nothing negative to report, which is always a good sign. I understand that LeeAnn is progressing and doing a good job with the arrangements for our next conference. If you happen to be in the Harrisburg area, give her a call and ask if you can help out or take her out for coffee. Every little bit helps including a little moral support, because it is not an easy task she has taken on.***

***Take care of yourselves and be good to one another.***

***Dan RAHN***

RESEARCH ARTICLE:

# **EXTREME TEMPERATURE EFFECTS ON BLOODSTAIN PATTERN ANALYSIS**

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## **INTRODUCTION**

The shedding of blood at violent crime scenes can provide significant information to assist the crime scene investigator in reconstructing fatal and non-fatal events. It is this examination of blood through "Bloodstain Pattern Analysis" that the investigator can work in concert with other disciplines of forensic science to verify or contradict a version of events provided by the suspect or witnesses. Bloodstain pattern analysis can also assist with determining where the victim was at the time of bloodshed, movement and directionality of persons or objects while blood is being shed, the number of blows received by a victim, an area of origin of that blood, and type and direction of impact. Individual bloodstains can be examined for size, shape, distribution and orientation (James, 1999). Measuring the width and length of well-formed bloodstains, and determining the arc sin through basic trigonometric functions on a calculator, can establish an impact angle. Utilizing angles of impact for several bloodstains in concert with their distances from an origin on a two-dimensional plane, an area of origin in space where the blood originated can be established. This area can be realized through the use of a protractor and string to project the angles from the stain. A three dimensional model is then constructed allowing one to visualize the area in space away from a horizontal or vertical surface (MacDonell, 1997).

The crime scene examiner often works in less than ideal conditions when attempting to reconstruct violent events. Scenes where blood has been shed occur in environments that are exposed to extreme temperatures. Research has been conducted on the effects of fire (extreme heat) on bloodstain patterns as well as observations recorded of stains at crime scenes in freezing environments. In both instances, the bloodstains generally retained their characteristics and remained suitable for interpretation (Eckert and James, 1993).

Although the effects of heat and cold on bloodstain patterns have been observed to some degree, comprehensive research does not appear to have been published which explored the effects of extreme temperature ranges on common non-porous surfaces. A review of research to date failed to locate published articles on the effects of both extreme temperatures ranges (heat & cold) on bloodstain patterns and subsequent interpretation. When non-porous surfaces are exposed to extreme cold and heat within ranges that could conceivably be found regionally, can directionality, angle of impact and area of origin be accurately determined? Does blood react differently when exposed to extreme temperatures than it does in normal ranges (ambient temperature) in appearance and drying times? This project attempted to address these questions to further assist in the interpretation of bloodstain patterns produced in violent crime.

## **MATERIALS AND METHODS**

Four different nonporous surfaces (painted drywall, linoleum flooring, ceramic tile and glass) were utilized to represent a wall, floor and window for 3 different temperature ranges and for 5 different types of bloodstains (36 surfaces total). Drywall and linoleum flooring were utilized as the primary surfaces whereupon directionality, point of convergence and impact angles were examined. The remaining surfaces were utilized for general comparison to the directionality of blood on drywall and linoleum.

Pieces of drywall measuring 2 x 2 feet were painted on one side with Duron White Flat Vinyl Acrylic Latex paint applied with a paintbrush. Sections of linoleum flooring were cut into sections measuring approximately 18 x 18 inches and stapled onto slightly larger pieces of plywood. Sixteen white ceramic wall tiles (6 x 6 inches) were mounted on a 2 x 2 feet piece of plywood utilizing commercially available tile adhesive and pre-mixed grout. For those sections designated for high velocity experiments, the tiles were placed around a drilled opening measuring approximately 6 inches in diameter. The smooth glass panes, measuring 12 x 12 inches, were utilized without a mounting, though a clear laminate was placed on one side (back) of the glass for the high velocity experiments.

- 1:** A standard 24W x 20H x 48L (inches) cardboard wardrobe box was utilized during high and medium velocity experiments (Figure #1). This allowed the target surfaces to be secured within the box and contain bloodspatter. A wooden pole was placed across the open top end of the box and a clamp attached to secure a piece of sponge with cardboard backing for use during the high velocity experiments. Upon disposal of the wardrobe box due to contamination, a cardboard box of lesser proportion was utilized in the same fashion. The panes of glass were also suspended from the clamp for the high and medium velocity experiments.
- 2:** A wooden containment chamber was constructed for use during the high temperature experiments (Figure #1). This box was lined with aluminum and a clear plastic covering supported by a plastic tent frame was used as a top covering to trap the heat. A space was left at one end for the placement of the firearm during high velocity experiments.

- 3: A laser guided hand held infrared thermometer along with a standard mercury and digital thermometer (which also recorded humidity) were utilized to record substrate, air within the controlled environments and ambient temperatures.
- 4: A mechanical mousetrap was utilized to simulate medium velocity bloodspatter. The center bar was taped to provide a surface that could impact blood placed directly on the mousetrap bait area (metal bait holder removed).
- 5: Tissue and surgical cloth were utilized for the creation of swipe and wipe bloodstains.
- 6: Disposable pipettes were utilized to release droplets of blood onto target surfaces.
- 7: Four standard 10ml vacutainer vials with an anti-coagulant were utilized for blood storage upon withdrawal from a human subject, drawn immediately before dispersal. Blood once drawn was kept at body temperature until used for any given experiment.
- 8: A 9mm Sig-Sauer P228 semi-automatic handgun with 9mm military ball ammunition.

### **Terminology**

**Low Velocity Stains:** Typically seen with venous bleeding, the effects of natural blood flow. Generally any non-spatter pattern, stains at least 4mm or larger in diameter. Resulting from normal gravitational forces or actions up to 5ft/s (swipes, wipes, drops).

**Swipe:** Transfer of blood onto an unstained surface by movement of a bloodstained object.

**Wipe:** Unstained object moves through an existing stain.

**Medium Velocity Stains:** Produced by impact with an instrument like a hammer or club. The preponderant bloodstains being between 1mm to 4mm in size, though bloodstains may also be produced which are smaller, the result of energy between 5 and 25ft/s.

**High Velocity Stains:** Classically produced by injury from a firearm. The preponderant of the bloodstains being 1mm or smaller, the result of energy in excess of 100ft/s (Bevel and Gardner, 1997).

A total of 5 different types of bloodstains were prepared on the 2 primary surfaces (drywall, linoleum) at 3 different temperatures. These surfaces were selected as they represent a wall and floor, common surfaces found at crime scenes. It was noted that the linoleum had ridges and valleys, or more specifically a “dimpled” texture. Glass and tile were utilized for general comparison to the directionality of blood on drywall and linoleum. The bloodstains were examined as low velocity, drops at a known angle, a swipe, a wipe, medium and high velocity spatter.

The target surfaces were subjected to temperature ranges representing extreme cold, ambient, and extreme hot. The subsequent non-microscopic changes that occurred to the blood

were recorded along with a range of drying times for each primary surface. Additionally, the point of convergence for the stains selected was constructed along with impact angles for those stains and the area of origin for the two primary target surfaces.

The point of convergence represents the location on a two-dimensional plane whereupon the blood was shed. Projected out from this point on a three-dimensional axis would provide an area of origin of that blood. This was determined by the "Tangent Method", a calculation achieved by using the tangent of the angle of impact multiplied by the distance of a specific stain from the point of convergence. This method is an acceptable alternative to using strings. It is important to note that the actual "area of origin" is in fact that, an area in space that is at or below the location indicated by the tangent method. A specific "point" of origin will not be determined. As the investigator may only be looking to determine if the victim was lying or standing at the time of bloodshed, this approximation is not a detriment to scene reconstruction (MacDonell, 1997).

The first experiment consisted of the placement of several droplets (0.05ml drop) of blood via a pipette onto a target surface positioned at a 45-degree angle. The second experiment created a "swipe" bloodstain by moving a blood soaked tissue or cloth over the target surface. The third experiment created a "wipe" bloodstain by moving a tissue or cloth through blood previously deposited on the target surface. The fourth experiment created a medium velocity bloodstain pattern on the target surface using blood dispersed by a mousetrap. The fifth experiment created a high velocity bloodstain pattern utilizing a 9mm handgun with ball ammunition fired through a blood soaked sponge suspended in front of the target surface. The Prince George's County Police, MD, firing range was utilized for the high velocity experiments. Drying times were determined by observation and touch.

## **RESULTS & OBSERVATIONS**

### **Experiment Series I**

The first series of experiments were conducted with painted drywall surfaces in cold, ambient and hot temperatures. Dripped blood, wipes, swipes, medium velocity and high velocity bloodstains were created. Surfaces D-1 and D-4 were created in a bulk storage freezer. D-7 was created at an outdoor firing range in January 2000. The hot temperatures were attained (July 2000) within a specially constructed chamber that was previously discussed in the "Materials and Methods" section. Recorded temperatures were rounded off to the nearest degree. Due to requirements for high velocity experiments in the cold range (firearm discharge), an outdoor firing range was utilized in the winter. This experiment should be repeated if an accurate comparison of drying times is to be considered, as the desired temperature was not attained (below 32 deg. F).

### Cold Temperature (F)

Stain	Drywall	Air Temp Humidity	Surface Temp	Start Time	Initial Freeze or Dry Time <sup>1</sup>	End Freeze - Dry Time & Final <sup>2</sup>
Drops	D-1	23/56%	27°	11.16	11.17	11.20/4m
Wipes	D-1	23/56%	27°	11.18	11.22	11.25/7m
Swipes	D-1	23/56%	27°	11.23	11.25	11.25/2m
Medium	D-4	23/56%	18°	12.25	12.58	12.58/33m
High	D-7	43/56%	N/A	8.59	9.05	9.21/22m

### Ambient Temperature (F)

Stain	Drywall	Air Temp Humidity	Surface Temp	Start Time	Initial Dry Time	Dry Time & Final
Drops	D-2	72/67%	71°	1.34	1.40	3.25/111m
Swipes	D-2	72/67%	71°	1.36	1.39	1.39/3m
Wipes	D-2	72/67%	71°	1.36	1.38	1.38/2m
Medium	D-5	72/67%	71°	2.42	2.45	3.19/37m
High	D-8	79/68%	78°	10.29	10.31	10.37/8m

<sup>1</sup> Represents the time freezing/drying was initially observed throughout the individual stain or pattern.

<sup>2</sup> Represents a range of times as observed for stains to completely freeze. Checked at intervals in freezer. Found completely frozen by touch of gloved hand as indicated by final time.

## Hot Temperature (F)

Stain	Drywall	Air Temp - Humidity <sup>3</sup>	Surface Temp	Start Time	Initial Dry Time	Dry time & Final
Drops	D-3	110/92/72%	102°	4.07	4.29	4.29/22m
Wipes	D-3	110/92/72%	102°	4.07	4.12	4.12/5m
Swipes	D-3	110/92/72%	102°	4.07	4.09	4.09/2m
Medium	D-6	112/92/72%	115°	2.55	2.56	2.56/1m
High	D-9	109/92/72%	113°	1.53	1.54	1.54/1m

Upon immediate examination of the drywall substrates when removed from the extreme cold environment, individual bloodstains had a frozen, crystal like appearance. After several minutes in ambient temperature (72 deg. F), the drips and wipes, placed at a 45-degree angle, started to thaw and run down the substrates. The outline of the original stain was preserved regardless of thawing. Upon general examination of the surfaces when placed side by side, the bloodstains were dark red in appearance from the cold experiment, less dark red/brown in the ambient range and a light red/brown in the hot range. This variance in color “may” be associated with drying times and/or aging of the bloodstains. Further experimentation on blood drying times in these temperature ranges is required before this question can be answered definitively. Bloodstains on all surfaces showed directionality and well-formed bloodstains were present on all surfaces. Upon magnification, the bloodstains showed a characteristic drying appearance, flaking and skeletonized stains with distinct cracks through the more dense part of the stain. The larger stains (>2mm) in D-4 (medium) and D-7 (high velocity) took 33 and 22 minutes to dry respectively in the cold range. D-2 (drops) and D-5 (medium velocity) took 111 and 37 minutes to dry respectively in the ambient temperature. In the hot temperatures, D-3 (drops) took the longest to dry at 22 minutes.

### Experiment Series II

The second series of experiments was conducted with linoleum flooring, cut into sections and stapled onto a piece of plywood. The substrates were exposed to the same temperature ranges as in series 1. Recorded temperatures were rounded off to the nearest degree. Due to requirements for high velocity experiments in the cold range (firearm discharge), an outdoor firing range was utilized in the winter. This experiment should be repeated if an accurate comparison of drying times in the cold range is to be considered as desired temperature was not attained (32 deg. F).

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<sup>3</sup> The experiment was conducted outside in a specially constructed chamber. The higher temperature is the temperature inside the chamber. The second temperature is the outside air temperature.



### Cold Temperature (F)

Stain	Linoleum Floor	Air Temp Humidity	Surface Temp	Start Time	Initial Dry Time	Dry Time & Total
Drops	L-19	23/64%	26°	12.56	1.09	2.23/87m
Wipes	L-19	23/64%	26°	12.56	1.09	1.14/18m
Swipes	L-19	23/64%	26°	12.56	1.09	1.14/18m
Medium	L-22	10/64%	18°	1.12	1.13	2.15/63m
High	L-25	43/68%	43°	9.28	9.33	9.50/22m

### Ambient Temperature (F)

Stain	Linoleum Floor	Air Temp Humidity	Surface Temp	Start Time	Initial Dry Time	Dry Time & Total
Drops	L-20	72/67%	71°	1.51	1.54	1.59/8
Swipes	L-20	72/67%	71°	1.52	1.56	1.59/7
Wipes	L-20	72/67%	71°	1.53	1.56	3.24/91
Medium	L-23	72/67%	70°	2.28	2.31	3.29/61
High	L-26	79/65%	N/A	10.23	10.49	10.49/26

### Hot Temperature (F)

Stain	Linoleum Floor	Air Temp Humidity	Surface Temp	Start Time	Initial Dry Time	Dry Time & Total
Drops	L-21	112/92%	113°	3.37	3.50	3.50/13m
Wipes	L-21	112/92%	113°	3.37	3.50	3.50/13m
Swipes	L-21	112/92%	113°	3.37	3.38	3.50/13m
Medium	L-24	112/92%	113°	3.03	3.04	3.15/12m
High <sup>4</sup>	L-27	110/92%	113°	1.43	1.45	1.47/4m

<sup>4</sup> Fine mist produced by high velocity impact appeared to dry almost immediately. Larger stains (>2mm) were observed for initial drying times.

Upon examination of the linoleum flooring removed from the cold temperature, the stains had a crystal frozen like appearance as observed for stains in the drywall cold tests. Once L-19 (drops and wipes) were removed from the freezing environment and placed at a 45-degree angle in ambient temperature (72 deg. F), the stains began to thaw and several larger (>2mm) bloodstains ran into others. Less running of stains was present on the linoleum than the drywall. The original outline of the impact stain appeared to be preserved regardless of thawing and subsequent drying. The larger stains on the flooring took a long time to freeze in the cold environment as well as in the ambient range. L-19 (drops) took 87 minutes to dry in the cold range, and L-22 (medium velocity) 63 minutes. L-20 (wipes) and L-23 (medium velocity) in the ambient range took 91 and 61 minutes to dry respectively. In the hot range, the drying times for all surfaces were between 4 and 13 minutes.

After being allowed to dry after thawing, the larger bloodstains (L-19) had a distinct fracture/demarcation line across the wide axis of the stain. There were parallel fracture lines obvious in the dense portion of these large stains, running from the center outward in both directions. Well-defined stains were present in the medium and high velocity range. Upon magnification, stains had a characteristic drying appearance, skeltonized with a dark red/brown appearance. The darker stains were on the cold surface, a lighter red/brown color to the stains in the ambient range and the lightest red/brown in the hot range. The color variance may be due to the aging and/or drying of the stain; further experimentation is required before this can be answered definitively. The linoleum flooring is most likely chemically treated to prevent staining and absorption of liquids. This process may have an effect on the reaction of fluid on the surface, possibly increasing drying times. Further inquiry is demanded in this regard.

### **Impact Angle Determination:**

Two well-defined bloodstains were selected (A and B) for measurement on low velocity surfaces D-1 through D-3, and L19 through L-21. The known angle was 45-degrees. Two separate examiners measured the stains. The average of the angles was utilized for comparison. D-1 through D-3 calculations resulted in a range from 43.4 to 45.4 degrees. L-19 through L-21 calculations resulted in a range from 44 to 47.2 degrees (Figure #2).

$$\text{Formula: } \arcsin \left( \frac{\text{width of bloodstain}}{\text{length of bloodstain}} \right) = \text{impact angle}$$

### **Point of Convergence & Area of Origin:**

Five individual bloodstains (A-E) were selected on medium and high velocity surfaces D-4 through D-9, and L-22 through L-27. The two-dimensional point of convergence was constructed by placing string through the long axis of the stain. The distance from each marked bloodstain to the convergence point was measured; the area of origin was calculated utilizing the Tangent Method and compared to the approximate location of blood dispersal (4 inches & 9 inches away from target). The area of origin was calculated in an accepted range of 1.5 and 4.5 inches from the known target surface (Figure #3 and #4).

**Formula:**  $TAN = \text{opposite/adjacent}$ ; the ratio to the length of the side *opposite* the angle to the length of the side *adjacent* to the angle. In bloodstain pattern analysis, this formula (Tangent Method) can be applied by measuring the distance from an individual stain to the point of convergence, multiplied by the tangent of the impact angle of the same stain. The resulting figure will provide the distance from the point of convergence to the area in space (three-dimensional) where the source of the blood originated (MacDonell, 1997).

### **Additional Substrates:**

Glass and tile substrates were also subjected to the same experimentation as the drywall and linoleum flooring to observe directionality in comparison to the drywall and linoleum surfaces. Directionality could be established on both surfaces, pointing to an area in the approximate center of the target (area of blood dispersal). Low velocity experiments yielded well defined stains at a known angle. The medium velocity bloodstains on tile and glass in the cold temperature range became diluted and smeared after application. Stains on glass and tile were also observed to run more readily than drywall and linoleum. The smooth surface of glass and tile contribute to this “run effect” (MacDonell, 1997).

## **CONCLUSIONS & FINDINGS**

Bloodstains created on the drywall and linoleum surfaces in the hot temperatures dried in less time than at the ambient and cold temperatures. This finding may assist investigators attempting to determine the age of bloodstain patterns. In the cold range, the stains appear to freeze upon impact, preserving the appearance of the stain. Although the range of drying times varied throughout the experiment, the overall bloodstain patterns remained consistent throughout the temperature ranges. On the primary surfaces, directionality of bloodstains, known angle, impact angle, and area of origin were reconstructed. The bloodstains and patterns on glass and tile also showed directionality that was consistent with the patterns on the drywall and linoleum. Although temperature may vary the drying times of bloodstains, this project showed that temperature does not adversely affect the overall characteristics of bloodstain patterns.

For future experiments to determine accurate drying times, a check of stains at designated intervals should be employed for all temperatures. Further experimentation in the cold range (high velocity) should be conducted for additional comparison. Further research with bloodstains on cloth in the same temperature ranges has been suggested as a continuance of this project.

A spreadsheet for the bloodstain measurements and the tangent method calculations are appended as Figures (2) and (3). Various photographs depicting the specially constructed heat chamber, application of blood on substrates in the freezer, and the results of the experiments on drywall, linoleum and tile are appended as Figure (1). Project participants retain the remainder of the numerous photographs taken throughout the experiment.

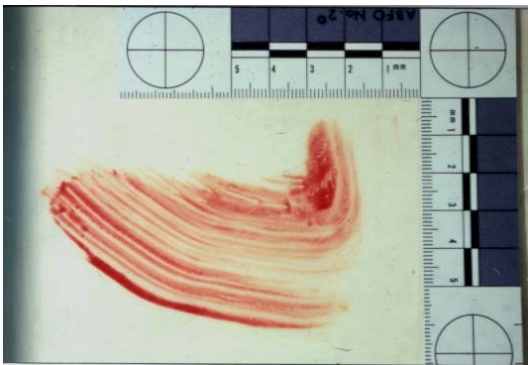
# FIGURE #1



Greenhouse to conduct hot range temperature experiments.



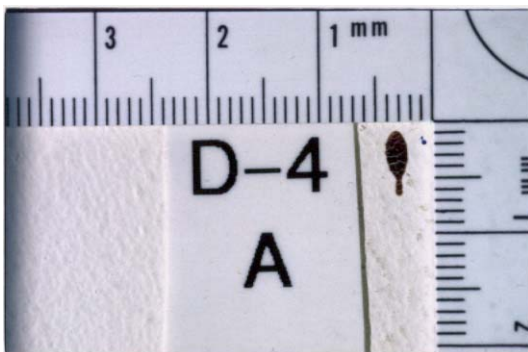
Low velocity on linoleum flooring in extreme cold range.



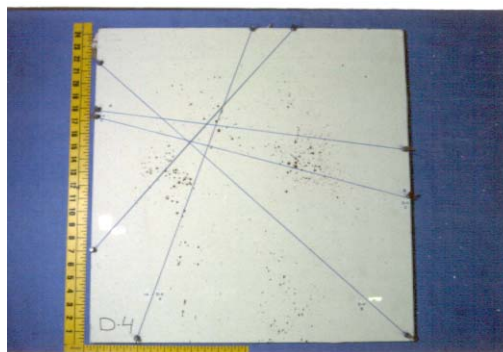
Swipe on flooring moments after removal from freezer.



Drops on flooring moments after removal from freezer.

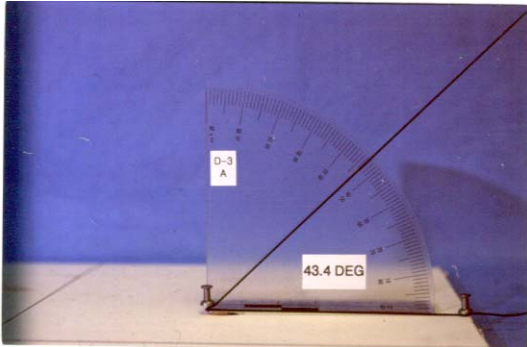


Medium velocity on drywall, Stain A, extreme cold temp. (18 deg. F)

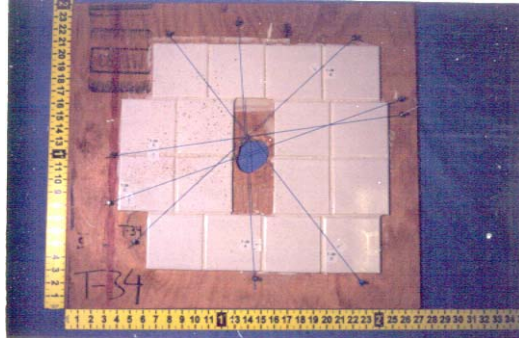


Convergence on drywall (D4), extreme cold range.

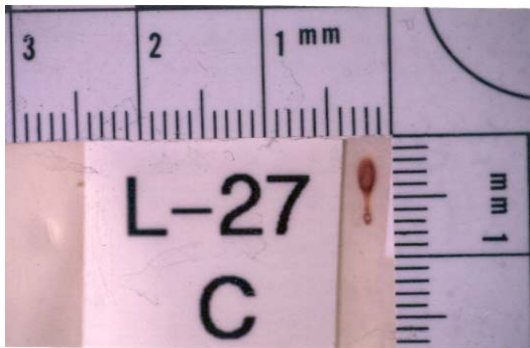
# FIGURE #1



Impact angle measured on drywall in hot temperature range. Actual drop @ 45°



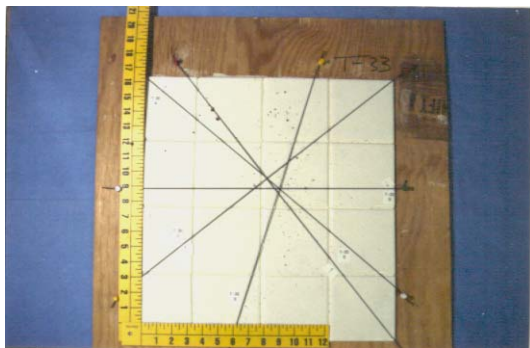
Point of convergence, high velocity tile in high temperature.



Stain C, high velocity / high temperature 113° on linoleum flooring.



Tile for high velocity experiment in a specially constructed chamber.



Point of convergence on tile, medium velocity.

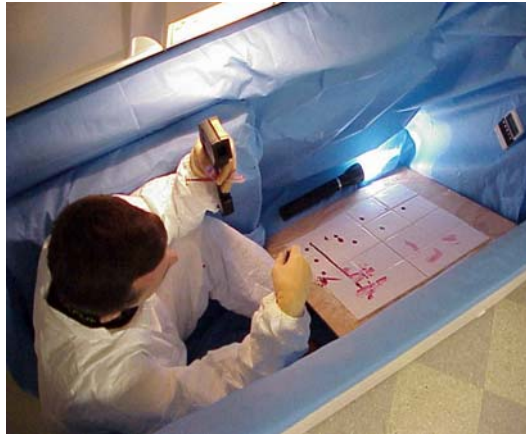


Stain B, medium velocity, high temperature range on tile.

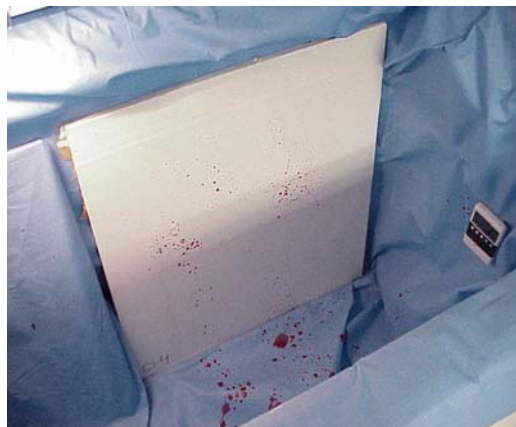
# FIGURE #1



Tile in freezer prior to low velocity experiment



Moments after low velocity application in freezer



Drywall after medium velocity experiment in freezer

FIGURE #2

**Bloodstain Measurements**

	A1			A2			AVG	B1			B2			AVG
	W	L	Angle	W	L	Angle		W	L	Angle	W	L	Angle	
<b>DRYWALL</b>														
D1- COLD	1.2	1.7	44.9	1.3	1.8	46	<b>45.45</b>	1.35	2	42.5	1.4	2	44.4	<b>43.45</b>
D2- AMBIENT	1.2	1.7	44.9	1.5	1.7	42.6	<b>43.75</b>	1.25	1.8	43.9	1.3	1.9	43.2	<b>43.55</b>
D3- HOT	1.1	1.6	43.4	1.1	1.6	43.4	<b>43.4</b>	1.1	1.6	43.43	1.1	1.6	43.43	<b>43.43</b>
D4 - COLD	2	4.6	25.7	2	4	30	<b>27.85</b>	1	2	30	1	1.8	33.7	<b>31.85</b>
D5- AMBIENT	1.3	1.8	46.27	1.3	1.7	49.8	<b>48.04</b>	0.8	2	23.58	1	1.9	31.7	<b>27.64</b>
D6- HOT	1	2	30	1.2	2.1	34.8	<b>32.4</b>	1	2	30	1	2	30	<b>30</b>
D7- COLD	0.8	1.7	28.1	0.8	1.6	30	<b>29.05</b>	0.9	2	26.7	0.9	2	26.7	<b>26.7</b>
D8- AMBIENT	0.6	1.4	25.4	0.6	1.4	25.4	<b>25.4</b>	0.6	1.2	30	0.6	1	36.9	<b>33.45</b>
D9- HOT	0.6	1.9	18.4	0.6	1.6	22	<b>20.2</b>	1.1	2.2	30	1.2	2.2	33.1	<b>31.55</b>
<b>LINOLEUM</b>														
L19- COLD	1.4	2	44.4	1.4	2	44.4	<b>44.4</b>	1.4	2	44.4	1.4	2	44.4	<b>44.4</b>
L20- AMBIENT	1.4	1.9	47.4	1.3	1.8	46.2	<b>46.8</b>	1.4	1.9	47	1.4	1.9	47.4	<b>47.2</b>
L21- HOT	1.2	1.8	41.8	1.3	1.8	46.2	<b>44</b>	1.2	2	41.8	1.3	1.9	43.1	<b>42.45</b>
L22- COLD	1.7	2.8	37.3	1.6	2.6	38	<b>37.65</b>	1.8	2.5	46	1.8	2.4	35.7	<b>40.85</b>
L23- AMBIENT	1.9	3.5	32.8	1.9	3.5	32.8	<b>32.8</b>	1.5	3.4	26.1	1.5	3.3	27	<b>26.55</b>
L24- HOT	1.1	2	33.3	1.1	2	33.3	<b>33.3</b>	1.2	1.6	48.5	1.2	1.7	44.9	<b>46.7</b>
L25- COLD	0.8	1.8	26.4	0.8	1.4	34.8	<b>30.6</b>	1	2	30	1	1.8	33.7	<b>31.85</b>
L26- AMBIENT	1.6	2.8	34.9	1.8	2.7	41.8	<b>38.35</b>	1.2	2	36.8	1.3	2.1	38	<b>37.4</b>
L27- HOT	1	3	19.5	1.1	3.2	20	<b>19.75</b>	1.3	4.5	16.8	1.3	4.5	16.8	<b>16.8</b>

A1/A2 through E1/E2 denote measurements taken by two different examiners of the same stain (A-E).

Stains A and B used for known angles.

Stains A through E used for point of convergence and area of origin.

FIGURE #2

**Bloodstain Measurements**

	C1			C2			AVG	D1			D2			AVG
	W	L	Angle	W	L	Angle		W	L	Angle	W	L	Angle	
<b>DRYWALL</b>														
D1- COLD							0							0
D2- AMBIENT							0							0
D3- HOT							0							0
D4- COLD	1	2.2	27	1	1.8	33.7	30.35	1.2	2	32.5	1	2	30	31.25
D5- AMBIENT	0.6	1.2	30	0.6	1.2	30	30	1.2	2	36.8	1.2	2	36.8	36.8
D6- HOT	2.4	4.8	30	2.4	5	28.6	29.3	0.6	1.4	25.38	0.8	1.5	32.2	28.79
D7- COLD	0.6	1.3	27.5	0.6	1.4	25.4	26.45	1	1.8	33.8	1	1.6	33.8	33.8
D8- AMBIENT	0.4	0.7	34.8	0.3	0.6	30	32.4	0.5	0.9	30	0.4	0.7	34.9	32.45
D9- HOT	0.9	2.3	23	0.9	2.4	22	22.5	0.3	1	17.5	0.3	1.1	15.8	16.65
<b>LINOLEUM</b>														
L19- COLD							0							0
L20- AMBIENT							0							0
L21- HOT							0							0
L22- COLD	1.9	3.3	35.1	1.8	3.8	28.3	31.7	1.3	4	18.9	1.2	3.6	19.5	19.2
L23- AMBIENT	2	4	30	2	4	30	30	1.6	2.6	37.9	1.5	2.5	36.8	37.35
L24- HOT	2.9	4	46.4	2.8	4	46.4	46.4	1.9	3.9	29.1	1.8	4.4	24.1	26.6
L25- COLD	1.5	3.2	27.9	2	2.8	45.6	36.75	1.5	3	30	1.4	2.8	30	30
L26- AMBIENT	1.3	1.8	46	1.3	1.9	43	44.5	1	1.5	42	1	1.5	42	42
L27- HOT	1.3	2.6	30	1.5	3.1	28.9	29.45	0.8	1.6	30	0.9	1.6	34	32

A1/A2 through E1/E2 denote measurements taken by two different examiners of the same stain (A-E).

Stains A and B used for known angles.

Stains A through E used for point of convergence and area of origin.



FIGURE #2

**Bloodstain Measurements**

	E1			E2			AVG
	W	L	Angle	W	L	Angle	
<b>DRYWALL</b>							
D1- COLD							0
D2- AMBIENT							0
D3- HOT							0
D4- COLD	1.1	1.8	37.8	1	1.5	41.8	39.7
D5- AMBIENT	0.6	0.9	41.8	0.6	0.9	41.8	41.8
D6- HOT	0.6	1	36.87	0.7	1.1	39.5	38.19
D7- COLD	0.9	1.7	31.9	0.8	1.4	34.9	33.4
D8- AMBIENT	0.8	1.3	37.9	0.8	1.2	42	39.95
D9- HOT	0.7	1.2	35.7	0.6	1	36.9	36.3
<b>LINOLEUM</b>							
L19- COLD							0
L20- AMBIENT							0
L21- HOT							0
L22- COLD	1.6	2.8	34.8	1.6	2.8	34.9	34.85
L23- AMBIENT	0.7	1.1	39.5	1.6	2.8	34.9	37.2
L24- HOT	1.1	2	33.3	1.1	2	33.4	33.35
L25- COLD	1.7	3	34.5	1.8	2.8	40	37.25
L26- AMBIENT	1.4	2.5	34	1.4	2.4	36	35
L27- HOT	0.6	1.4	25.4	0.7	1.5	27	26.2

A1/A2 through E1/E2 denote measurements taken by two different examiners of the same stain (A-E)

Stains A and B used for known angles.

Stains A through E used for point of convergence and area of origin.

FIGURE #3

TANGENT METHOD

	Angle	Distance of Stain to Point of Convergence(in.)	Tangent (in.)	Average Range of Distance To Target(in.)	Known substrate to target distance(in.)
<b>L22</b>	<b>COLD</b>				
A	37.6	11.7	9		
B	40.8	11.5	9.9		
C	31.7	12.5	7.7		
D	19.2	8.2	2.8		
E	34.8	10.2	7.1		
<b>L23</b>	<b>AMBIENT</b>			<b>7.30</b>	<b>9</b>
A	32.8	13.2	8.5		
B	26.5	18	8.9		
C	30	15	8.6		
D	37.3	14	10.6		
E	39.5	7	5.7		
<b>L24</b>	<b>HOT</b>			<b>8.46</b>	<b>9</b>
A	33.3	9.5	6.2		
B	46.7	4.3	4.5		
C	46.4	4.2	4.4		
D	26.6	6	3		
E	33.4	6.5	4.2		
<b>L25</b>	<b>COLD</b>			<b>4.46</b>	<b>9</b>
A	30.6	9.8	5.7		
B	31.9	11.5	7.1		
C	36.5	12.5	9.2		
D	30	10.2	5.8		
E	37.3	8.6	6.5		
<b>L26</b>	<b>AMBIENT</b>			<b>6.86</b>	<b>8</b>
A	38.4	7.7	6.1		
B	37.4	11.7	8.9		
C	44.5	10.7	10.5		
D	42	7.7	6.9		
E	35	12.2	8.5		
<b>L27</b>	<b>HOT</b>			<b>8.18</b>	<b>9</b>
A	19.8	4.5	1.6		
B	16.8	5.2	1.5		
C	29.5	7.2	4		
D	32	7.2	4.4		
E	26.2	6.2	3		
				<b>2.90</b>	<b>4</b>

# FIGURE #3

## TANGENT METHOD

	Angle	Distance of Stain to Point of Convergence(in.)	Tangent (in.)	Average Range of Distance To Target(in.)	Known substrate to target distance(in.)
<b>D4</b>	<b>COLD</b>				
A	27.9	11.75	6		
B	31.9	17.6	10.1		
C	30.4	16.6	8.7		
D	31.3	7.6	5.2		
E	39.7	8.7	6.9		
				<b>7.38</b>	<b>9</b>
<b>D5</b>	<b>AMBIENT</b>				
A	48	9.5	10.5		
B	27.6	11.7	6.1		
C	30	9.7	5.6		
D	36.8	12.2	9.1		
E	41.8	10.1	9		
				<b>8.06</b>	<b>9</b>
<b>D6</b>	<b>HOT</b>				
A	32.4	8.6	5.4		
B	30	10.7	6.1		
C	29.3	9.5	5.3		
D	28.7	9.2	5		
E	38.1	10.2	7.9		
				<b>5.94</b>	<b>9</b>
<b>D7</b>	<b>COLD</b>				
A	29	12.5	6.9		
B	26.7	9	4.5		
C	26.4	6.2	3		
D	33.7	8.8	5.8		
E	33.4	10.75	7		
				<b>5.44</b>	<b>9</b>
<b>D8</b>	<b>AMBIENT</b>				
A	25.3	8	3.7		
B	33.4	11	7.2		
C	32.4	10.5	6.6		
D	32.4	12.5	7.9		
E	39.8	10	8.3		
				<b>6.74</b>	<b>9</b>
<b>D9</b>	<b>HOT</b>				
A	20.2	4.2	1.5		
B	31.5	6.9	4.2		
C	22.5	7.5	3.1		
D	16.6	4	1.1		
E	36.2	5	3.6		
				<b>2.70</b>	<b>4</b>

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## **ACKNOWLEDGEMENTS**

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The authors may be contacted with any questions or comments at [TBrady@ncis.navy.mil](mailto:TBrady@ncis.navy.mil) or [JTigmo@ncis.navy.mil](mailto:JTigmo@ncis.navy.mil).

**IABPA Annual Training Conference**  
Harrisburg, Pennsylvania  
October 2-4, 2002

Planning to attend?? Kindly phone or email LeeAnn Singley (see below) and indicate your intention to attend (no obligation). A brief contact will assist in the ongoing conference planning.

**CONFERENCE CONTENT\***

CASE PRESENTATIONS  
VALIDATION STUDIES ON BACKTRACK®/IMAGES PROGRAM  
NEW APPROACHES TO TRAINING  
SCIENTIFIC WORKING GROUP UPDATES  
SHOOTING STUDIES  
MEET WITH THE IABPA BOARD MEMBERS  
ANNUAL MEMBERSHIP MEETING

The Annual Conference is a great opportunity to be a presenter and offer a case or ongoing research to be reviewed and discussed by fellow and experienced members of the IABPA. As an attendee you will be given the opportunity to share your comments, questions and ideas. Remember....this is YOUR conference....help to make it a memorable one!!!!

*Time slots for presentations will be limited. Contact LeeAnn Singley (Conference Coordinator) or Paul Kish (Program Coordinator) now to ensure your place on the conference agenda.*

LeeAnn Singley  
PA State Police  
(717) 705-8443  
[lsingley@state.pa.us](mailto:lsingley@state.pa.us)

Paul Kish  
Forensic Consultant  
(607) 962-8092  
[pkish@localnet.com](mailto:pkish@localnet.com)

If possible, we request that presentations be one half hour or less to allow more to participate. We also ask that you submit a short abstract (300-600 words) to be placed in the conference notebook.

\* CONFERENCE CONTENT IS TENTATIVE. CHECK THE IABPA WEBSITE  
([WWW.IABPA.ORG](http://WWW.IABPA.ORG)) AND UPCOMING NEWSLETTERS FOR UPDATED INFORMATION  
THROUGHOUT THE YEAR.

NOTE: A small conference room will be available Wednesday evening, for those wishing to share an unsolved or ongoing case in a "less formal" setting. Bring slides or photographs to "brainstorm" with your colleagues.....Interested? Contact LeeAnn or Paul.

## 2002 CONFERENCE REGISTRATION INFORMATION

**REGISTRATION FORM:** Complete the enclosed registration form and submit it to:  
LeeAnn Singley  
Pennsylvania State Police  
1800 Elmerton Avenue  
Harrisburg, PA 17110  
(717) 705-8443  
or **FAX** to: (717) 772-3267 Attn: LeeAnn Singley

REGISTRATION MUST BE ACCOMPANIED BY PAYMENT. SEE PAYMENT OPTIONS BELOW.

---

**FEES:**       **\$185.00 USD PRIOR TO SEPTEMBER 1, 2002**  
                  **\$200.00 USD AFTER SEPTEMBER 1, 2002**  
                  **\$230.00 USD ON-SITE PAYMENT**

**STUDENT: \$150.00 PRIOR TO SEPTEMBER 1, 2002**  
                                  **\$175.00 AFTER SEPTEMBER 1, 2002**

**\*REFUND REQUESTS MUST BE MADE PRIOR TO SEPTEMBER 1, 2002**

---

### **PAYMENTS: BY CHECK OR CREDIT CARD**

**CHECK PAYMENT:** MAKE PAYABLE TO: **IABPA**  
MAIL TO: Lee Ann Singley  
              Pennsylvania State Police  
              1800 Elmerton Avenue  
              Harrisburg, PA 17110

**CREDIT CARD PAYMENT:** (VISA, MASTERCARD, AMERICAN EXPRESS)  
CONTACT: Norman Reeves  
              (520) 760-6620  
              EMAIL: [norman@bloody1.com](mailto:norman@bloody1.com)

**IABPA Federal ID# 52-1597063**

ON-SITE REGISTRATION WILL BEGIN AT 3:00 PM ON  
TUESDAY, OCTOBER 1, 2002 AT THE HOTEL

**IABPA Annual Training Conference**  
**Harrisburg, Pennsylvania**  
**October 2-4, 2002**

**ADDITIONAL CONFERENCE INFORMATION**

**AWARDS BANQUET:**

The Annual Awards Banquet will be held on Thursday evening, October 3, 2002. Plans are underway to hold the banquet at the recently established **NATIONAL CIVIL WAR MUSEUM**. This museum attempts to portray both sides of "The War Between the States" and this unique evening will include a dinner (of civil warfare), dancing and access to the gallery to explore at your leisure.....It is sure to be a night to remember. You can learn more about the museum at [www.nationalcivilwarmuseum.org](http://www.nationalcivilwarmuseum.org)

**AREA ATTRACTIONS:**

Harrisburg is Pennsylvania's state capital and located in the center of much of the history that has taken place in the "birthplace of America." While in the area, consider visiting **Gettysburg** (the site of the bloodiest battle of the Civil War and President Lincoln's Gettysburg Address – a must see for civil war enthusiasts), or taking in **Lancaster County's Amish Country** (experience the Amish, who still live without electricity and travel in horse drawn buggies). Or simply spend an evening touring nearby **Hershey**, the "Sweetest Place on Earth." Drive down "Chocolate Avenue" where streetlights are shaped like Hershey kisses and sample some chocolate at the free chocolate factory tour. If spending extra days in the area, **Philadelphia**, **Baltimore** and even **Washington D.C.** are all a day trip away and, since it is the fall.....a drive north toward the **Pocono Mountains** will surely provide an excellent display of an east coast autumn.

For more information on area attractions, access the following websites:

[www.pacapitalregions.com](http://www.pacapitalregions.com) -- for information on Pennsylvania's capital city

[www.gettysburg.com](http://www.gettysburg.com) -- for information on Gettysburg, PA

[www.800padutch.com](http://www.800padutch.com) -- for information on Lancaster County/Amish Country

**2002 IABPA Annual Training Conference**  
**Harrisburg, Pennsylvania**  
**October 2-4, 2002**

**HOTEL INFORMATION**  
**HARRISBURG HILTON AND TOWERS**  
One North Second Street  
Harrisburg, Pennsylvania 17101  
(717) 233-6000

**Rates:** \$95.00 USD Single/Double ( + 6% PA State Occupancy and 3% Local Taxes)  
\$105.00 USD Triple/Quad

Reservation Code: **BPA000** Identify the **IABPA** when making your reservations

Rates will be offered on a first come, first serve basis. The room block is limited and will be held at these rates until **August 15, 2002**.

**THE HILTON WILL SELL OUT IN OCTOBER!! MAKE YOUR RESERVATIONS NOW TO ENSURE THE CONFERENCE RATE. IT'S NEVER TOO EARLY!!!!!!**

**Airport Transportation:** The Harrisburg Hilton offers free shuttle service to/from Harrisburg International Airport

**Parking:** For those traveling by car, the Hilton's parking rates are:  
Overnight guests.....\$5.00 / Evening – Unlimited Exits  
Banquet & Meeting Guests.....\$3.00 / Exit

**Rental Car:** The Harrisburg Hilton offers an on site rental car agency which is providing special conference rates for daily rentals if interested in day tripping before or after the conference. Daily rates (including 200 free miles) are: Economy \$27.00, Midsize \$31.50, Full size \$37.95. Additional miles \$0.19/mile. Rates subject to applicable taxes.

**Area Offerings:** The Harrisburg Hilton is situated in the downtown area and is surrounded by a variety of restaurants and clubs all within walking distance. The Hilton is also attached to a shopping center that offers a food court for “faster” eating. In addition, the hotel is a block away from the Susquehanna River, which provides a backdrop to several miles of river walk for those wishing to take a morning or afternoon jog/walk.

FOR ADDITIONAL INFORMATION ON THE AMENITIES OFFERED BY THIS PREMIER HOTEL IN THE HARRISBURG AREA, VISIT THEIR WEBSITE AT [WWW.HILTON.COM](http://WWW.HILTON.COM) AND ENTER “HARRISBURG, PENNSYLVANIA” IN THE HOTEL SEARCH/LOCATOR



**IABPA Annual Training Conference**  
Harrisburg, Pennsylvania  
October 2-4, 2002

**TRANSPORTATION INFORMATION**

**Airline Information:** US Airways has been selected as the official airline of the 2002 IABPA Conference and is offering discounted rates for those traveling into Harrisburg International Airport. These rates will apply to both domestic and international travel (*US Airways offers daily non-stops to Philadelphia from a number of European cities, such as London and Amsterdam, with connecting service to Harrisburg - as well as offering service from various cities in Canada*)

For reservations, contact the Group and Meeting Reservation Office toll free at (877) 874-7687. **Refer to Gold File Number 34132334**

Reservations may also be made on-line at [www.usairways.com](http://www.usairways.com). You will need to book under the "Meetings and Conventions" options and enter the meeting ID number - MTG000026

**Alternate Airports:** Although US Airways discounts apply only to those flying into Harrisburg International Airport, lower fares may be available for those who choose to arrive at alternate airports.

Philadelphia International Airport – approx. 2 hours drive to Harrisburg  
Baltimore/Washington International (BWI) Airport – approx. 1.5 hours

No shuttle service is available to Harrisburg from these airports. However, arriving at either airport would offer a scenic drive through southern Pennsylvania and/or northern Maryland if you desire to arrive in Harrisburg by rental car.

**Rental Car:** AVIS Rental Car agency is offering discounted rates for the conference attendees. Contact AVIS toll free at (866) 629-6995. Reference **AWD K609400**

TRANSPORTATION TO AND FROM THE CONFERENCE IS THE RESPONSIBILITY OF  
THE INDIVIDUAL ATTENDEE

# Training Opportunities

**August 5-9, 2002**

**Basic Bloodstain Pattern Analysis**

Kansas City, Missouri



Karen Russo

1100 East Red Bridge Road

Kansas City, MO 64131

Voice: 816-247-8663

Fax: 425-928-4210

E-mail: DeathInstitute@aol.com

\*\*\*\*\*

**September 23-27, 2002**

**Fall Bloodstain Institute**

Corning, New York



Herbert L. MacDonell

Bloodstain Evidence Institute

P.O. Box 1111

Corning, New York

Voice: 607-962-6581

Fax: 607-936-6936

E-mail: forensic@localnet.com

\*\*\*\*\*

**October 2-4, 2002**

**International Association  
of Bloodstain Pattern Analysts  
Annual Training Conference**

Harrisburg, Pennsylvania



LeeAnn Singley

Pennsylvania State Police

717-705-8443

E-mail: lsingley@state.pa.us

\*\*\*\*\*

**October 14-18, 2002**

**Basic Bloodstain Pattern Analysis**

Indianapolis, Indiana



Lt. J. Steve Kohne

106 Tamiami Trail

West Lafayette, IN 47906

Voice: 765-423-9388, Ext. 232

Fax: 765-423-4155

E-mail: sajok@earthlink.net

**December 9-13, 2002**

**Basic Bloodstain Pattern Analysis**

Appleton, Wisconsin



Daniel Feucht

Fox Valley Technical College

Criminal Justice Department

1825 N. Bluemound Drive

Appleton, WI 54912

E-mail: feucht@fvtc.edu

\*\*\*\*\*

**December 9-13, 2002**

**Bloodstain Pattern Analysis**

**Workshop**

Miami, Florida



Toby L. Wolson, M.S.

Miami-Dade Police Department

Crime Laboratory Bureau

9105 NW 25<sup>th</sup> Street

Miami, FL 33172

Voice: 305-471-3041

Fax: 305-471-2052

E-mail: noslow55@hotmail.com

\*\*\*\*\*

**May 5-9, 2003**

**Advanced Bloodstain Pattern Analysis**

Appleton, Wisconsin



Daniel Feucht

Fox Valley Technical College

Criminal Justice Department

1825 N. Bluemound Drive

Appleton, WI 54912

E-mail: feucht@fvtc.edu

*Training announcements for the  
September 2002 Newsletter must be  
received before August 19, 2002.*

## Editor's Message

It seems as though I was just preparing the March Issue of the News. I would like to thank Tom Brady, John Tigmo, and Grant Graham for their hard work on the article appearing in this issue of the *News*. It takes people like Tom, John and Grant to make the News a viable organizational journal. This type of work not only assists the News but it also contributes to our discipline. I would strongly urge the rest of the membership to consider submitting their work for publication.

We currently have one other technical note in the editorial review process.

A member has submitted a request to me regarding slow motion videos. If you have a slow motion video, which would apply to our discipline and would be willing to make copies available to the membership, drop me a line. I feel that the News is a good medium for conveying general request like this to the membership.

LeeAnn has indicated to me that several of you have already contacted her regarding presentation time slots. If you are intending to make a presentation in Harrisburg, please do not delay in contacting LeeAnn. In addition, the hotel is reserving only a set number of rooms at the conference rate. Make your reservations soon!

Call for papers: The IABPA News needs research papers and case studies for publication in future issues. If you have been doing research in bloodstain pattern analysis or have an interesting case, please share it with all of us. Send your completed article to:

Paul Erwin Kish  
P.O. Box 814  
Corning, New York 14830  
Tel: (607) 962-8092  
Fax: (607) 962-2093  
E-mail: [pkish@localnet.com](mailto:pkish@localnet.com)

\*\*\*\*\*

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