Mississippi Forensic News

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From the President

Greetings,

I am thrilled to be serving this great organization as your newly elected President for the 2022-2023 year. I have been involved in the Mississippi Division of the International Association for Identification (MDIAI) for quite some time, serving as a Board of Director and Secretary. The MDIAI has always been dedicated to providing quality training for our Forensic Science community, Law enforcement community, crime scene units, coroners, as well as our educational community.

The 2022 Annual Training Conference held in Hattiesburg, MS was a huge success. Thanks to all the hard work from dedicated individuals within the MDIAI, the Forensic Science Society at USM, vendors and sponsors, and to all that attended. Without you and your support, this training conference would not have been possible, so thank you.

Shannon Roy

MDIAI President 2022-2023

The MDIAI has made some changes this year to allow us to grow as an organization. We have created a temporary committee to provide communication with our educational professionals and to promote more student involvement, research, and job opportunities within our division. We also created an overall certification committee to encourage external certification within the field of Forensic Science through our parent body, the International Association for Identification (IAI). This committee will also offer insight into the certification programs and process, as well as how they are beneficial. I encourage all to seek this certification.

One of my goals as President is to provide more benefits to our MDIAI members by offering a members only page on our website which will offer training material and resources (classes and webinars), a newsletter, renewals and membership status, log ins, and much more. I would also like to expand our committees within the MDIAI to work more closely with our coroners, medical examiners, and our educational professionals. We are in the planning stages for the 2023 Annual Conference on the MS Gulf coast, so be on the lookout for more information in the coming weeks and be sure to check out our website at www.mdiai.com.

In closing, I look forward to serving you this upcoming year and welcome any questions, comments, or suggestions. If interested in serving within the MDIAI, you can contact myself, the Officers, or the Board of Directors on our website. I hope to see everyone on the Gulf coast!

Inside this issue:

2022 CONFERENCE

Hattiesburg, MS

KEYNOTE

DR. DAVID MITTELMAN

OTHRAM

SPEAKERS

Dr. David Mittelman—Othram

MS State Medical Examiners Office

Jon Byrd—Ethics

Olivia Normand—Crime Mapping

Andy "Ski" Matuszewski—LEAPS

Jamie Bush—Court Room Testimony

2022 CONFERENCE

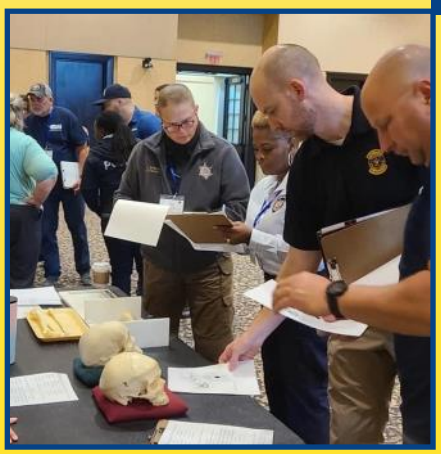
Workshops

Crime Scene Documentation
Ashley Aucoin

Forensic Anthropology: The Basics
Dr. Marie Danforth

Latent Prints: Back to the Basics
Gabe Regan

Shooting Incident Documentation
George Chaix



2022 CONFERENCE

Student Research Presentations

ANGELA FERGUSON

1,2-Indanedion testing on Real and Counterfeit Currency

KATIE MAYER

The Effects of Weather and Time on the Comparison Value of Latent Fingerprints

DANIEL PERKINS

The Degradation of Blood

MDIAI

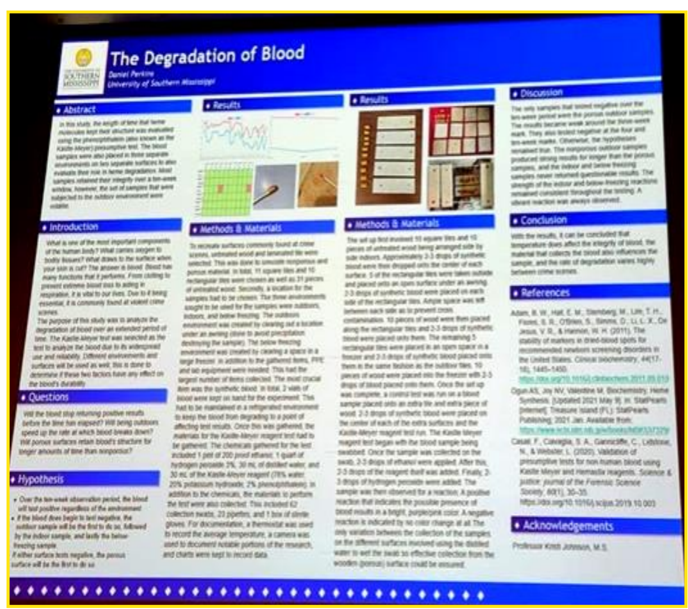
Mississippi Division of the
International Association for Identification

More photos and highlights from the 2022 Conference are available on our Facebook page.

STUDENT RESEARCH WINNER

Daniel Perkins

Daniel Perkins grew up in the small town of Gloster, MS. At a young age, he was introduced to the world of criminal justice by his father who was a sheriff. This led to Daniel gaining a desire to step into the field of crime-solving which eventually resulted in him pursuing an undergraduate degree in forensic science from the University of Southern Mississippi. In addition to this, Daniel also received a commission from the United States Air Force and was selected as an aircraft pilot. He hopes to one day retire from the military and work to become a sheriff, so he can follow in his father's footsteps.



RATE OF DEGRADATION OF BLOOD

Abstract

In this study, the length of time that heme molecules kept their structure was evaluated using the phenolphthalein (also known as the Kastle-Meyer) presumptive test. The blood samples were also placed in three separate environments on two separate surfaces to also evaluate their role in heme degradation. Most samples retained their integrity over a ten-week window, however, the set of samples that were subjected to the outdoor environment were volatile.

Introduction

Statement of the Problem

What is one of the most important components of the human body? What carries oxygen to bodily tissues? What draws to the surface when your skin is cut? The answer is blood. Blood has many functions that it performs. From clotting to prevent extreme loss, to aiding in respiration, it is vital to our lives. Because everyone has blood, it is commonly found at crime scenes.

Blood at crime scenes can be indicative of many things. For one, it can show who was at a crime scene, and it can also provide the trajectory of the weapon or object used in a violent crime. However, there can be issues with using blood as evidence. For one, blood is not always readily available to the naked eye. In the past, this led to roadblocks in investigations. In modern times, invisible blood can be enhanced using fluorescent / chemiluminescent chemicals. After being treated with these chemicals, the once invisible blood develops a "glow." The main differentiating factor between these two chemicals is that chemiluminescent chemicals cause a glow after simply mixing it with blood. Fluorescent chemicals require the use of something known as an alternate light source (ALS). An ALS is simply a light source that can emit light at different wavelengths.

Another issue is the identification of blood. How should an investigator know if a substance at a crime scene is blood? Could they eye it? Maybe, blood does have a very distinct appearance, especially when dried, but could other things appear similar to it? These questions are answered by testing. If an investigator believes a substance to be blood, tests can be run to either confirm or deny these suspicions. The only issue with this is the degradation and dilution of blood. Each blood test has a different route to identification. With the structural degeneration of blood, certain tests begin to produce false-negatives, or tests that result in a negative result when it should show a positive. This issue will be the focus of this study.

Purpose of the Study

The purpose of this study is to analyze the degradation of blood over an extended period of time. The Kastle Meyer test was selected as the test to analyze the blood due to its widespread use and reliability. The Kastle Meyer test uses heme molecules as its main blood marker. The caveat with this test being that it is only presumptive. This means that even with a positive result, the sample tested still must be further tested to confirm the true presence of blood. To measure the rate of degradation with this test, different environments and surfaces will be used in conjunction with time; this is done to determine if these two factors have any effect on the blood's durability. Will the blood stop returning positive results before the time has elapsed? Will being outdoors speed up the rate at which blood breaks down? Will porous surfaces retain blood's structure for longer amounts of time than nonporous? These questions are sought to be answered by the research.

Research Hypotheses

The research that will be performed will seek to indicate the rate at which blood degrades to a point where it is no longer be detectable by the Kastle-Meyer tests. The following are the hypotheses:

- Over the ten-week observation period, the blood will test positive regardless of the environment.
- If the blood does begin to test negative, the outdoor sample will be the first to do so, followed by the indoor sample, and lastly the frozen sample.
- No matter whether the surface be porous or nonporous, the results will be the same.
- If either surface tests negative, the porous surface will be the first to do so.

Justification of the Study

This study has value to the current procedures of crime scene investigation. If found to test negative prior to the ten-week mark, then future investigations should take the age of the scene into account. This will especially be the case for investigators that often utilize the Kastle-Meyer test. This could allow investigators to pursue avenues previously thought to be non-existent due to a false-negative test. Perhaps more mindfulness and greater attention to detail could be a result of this research. With the possibility of deoxyribonucleic acid (DNA) extraction from the blood, it would also be advantageous to test possible blood further rather than use the Kastle-Meyer test to determine that there is no blood present. If the scene appears to be older; forgoing the Kastle-Meyer test may present greater value to the possibility of solving the crime. Of course, the values of this research are contingent upon the success, or failure, of the hypotheses outlined above.

Limitations of the Study

The major limitation of this study is the use of artificial blood as opposed to real blood. Artificial blood, for the purposes of this study, mimics real blood incredibly well. The key reactive components for the Kastle-Meyer test to test positive are present in the artificial blood (Murphy 2016). There is also an advantage of using artificial blood due to it not being capable of transmitting pathogens. The major drawback to using artificial blood is the possible error in production and/or improper storage. An error in manufacturing and/or storage could lead to skewed results in the study.

Some minor limitations include the short amount of time for the observation. Ten weeks may not be sufficient time to warrant a negative result. Of course, it is also possible that it may never produce a negative result. Another minor limitation is the possible contamination of the blood that is in the outdoor environment. With enough contamination, the results of the tests could contain error.

Assumptions of the Study

For the study, an assumption of the artificial blood being structurally sound is made. As mentioned before, a manufacturing or storage error is possible, however, to assume this to be the case would dismantle the entire study. Another assumption is the Kastle-Meyer test will producing accurate results. A control test will be run to ensure proper function; however, future tests will be assumed to be accurate. The assumption of no cross contamination between samples will also be made. Great caution will be taken with the samples during testing. This will ensure minimal cross contamination and should not affect results. The final assumption made is the proficiency of the tester when performing tests. It is assumed that the individual running the tests is competent to perform them and able to do so without error.

Methods

Materials

The research performed in this experiment mostly utilized simple materials. The base for this experiment involved finding suitable surfaces to place each sample onto. To recreate surfaces commonly found at crime scenes, untreated wood and laminated tile were selected. This was done to simulate a nonporous and porous material to differentiate the effects it would have on blood. In total, 11 square tiles and 10 rectangular tiles were chosen for the nonporous material. 31 pieces of untreated wood were chosen as the porous material.

Secondly, a location for the samples had to be chosen. The three environments sought to be used for

the samples were outdoors, indoors, and below freezing. The indoor environment was relatively easy to locate as it was simply inside a building. The outdoor environment was created by clearing out a location under an awning (done to keep precipitation from destroying the sample). Finally, the below freezing environment was created by clearing a space in a large freezer and setting the temperature to 3 degrees Fahrenheit.

The third set of materials had to do with lab equipment. This had the largest number of items collected. The most crucial item was the synthetic blood. In total, 2 vials of blood were kept on hand for the experiment. This had to be maintained in a refrigerated environment to keep the blood from degrading to a point of affecting test results. Once this was gathered, the materials for the Kastle Meyer reagent test had to be gathered. The chemicals gathered for the test included 1 pint of 200 proof ethanol, 1 quart of hydrogen peroxide 3%, 30 mL of distilled water, and 30 mL of the Kastle Meyer reagent (78% water, 20% potassium hydroxide, 2% phenolphthalein). In addition to the chemicals, the materials to perform the test were also collected. This included 62 collection swabs, 23 pipettes, and 1 box of sterile gloves.

For documentation purposes, a thermostat was used to record the average temperature and humidity, a camera was used to document notable portions of the research, and charts were kept to record data.

Procedure

The set up involved 10 square tiles and 10 pieces of untreated wood being arranged side by side indoors. Approximately 2-3 drops of synthetic blood were then placed onto the center of each surface. 5 of the rectangular tiles were taken outside and placed onto an open surface under an awning. 2-3 drops of synthetic blood were placed on each side of the rectangular tiles. Ample space was left between each side as to prevent cross contamination. 10 pieces of wood were then placed along the rectangular tiles and 2-3 drops of synthetic blood were placed onto them. The remaining 5 rectangular tiles were placed in an open space in a freezer and 2-3 drops of synthetic blood placed onto them in the same fashion as the outdoor tiles. 10 pieces of wood were placed into the freezer with 2-3 drops of blood placed onto them.

Once the set up was complete, a control test was run on a blood sample placed onto an extra tile and extra piece of wood. 2-3 drops of synthetic blood were placed on the center of each of the extra surfaces and the Kastle Meyer reagent test run. The Kastle Meyer reagent test began with the blood sample being swabbed. Once the sample was collected on the swab, 2-3 drops of ethanol were applied. After this, 2-3 drops of the reagent itself was added. Finally, 2-3 drops of hydrogen peroxide were added. The sample was then observed for a reaction. A positive reaction that indicates the possible presence of blood results in a bright, purple/pink color. A negative reaction is indicated by no color change at all. The only variation between the collection of the samples on the different surfaces involved using the distilled water to wet the swab so effective collection from the wooden (porous) surface could be ensured. Once the control samples were tested, and the validity of the test ensured, the samples were left to time.

Every week at approximately 5:00 pm EST, a sample was collected from one tile and one piece of wood from each of the three environments. The Kastle Meyer reagent test was run on each sample and the positive or negative result recorded on a chart. The average weekly temperature and humidity of the area where the samples were located was then collected and recorded. Throughout the testing, noteworthy test results were also documented via photography. This was repeated for 10 weeks.

Data and Conclusion

The first week of testing began on the 19th of September and the final week of testing ended on the 21st of November. This is noteworthy due to the changes in temperature observed over the course of the project. The outdoor samples began at a rather hot, humid climate and ended at a much cooler and dryer one. Over the ten weeks, the temperature changes were as follows (Figure 1).

A notable change in temperature was observed throughout the time the sample was outdoors. This is important for a conclusion that will be drawn. Mid-October is where the significant temperature

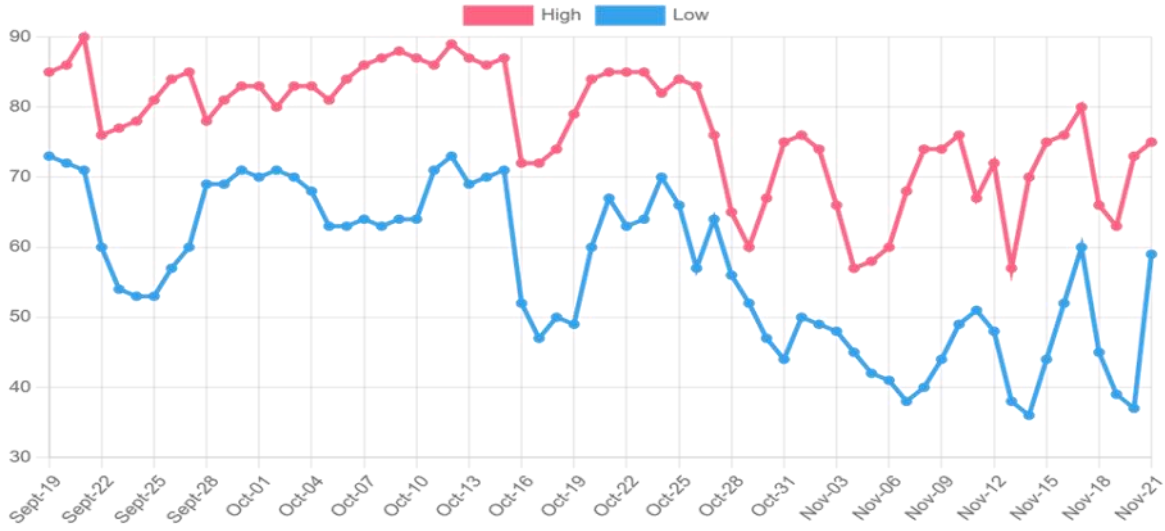


Figure 1 Average Temperature (F)

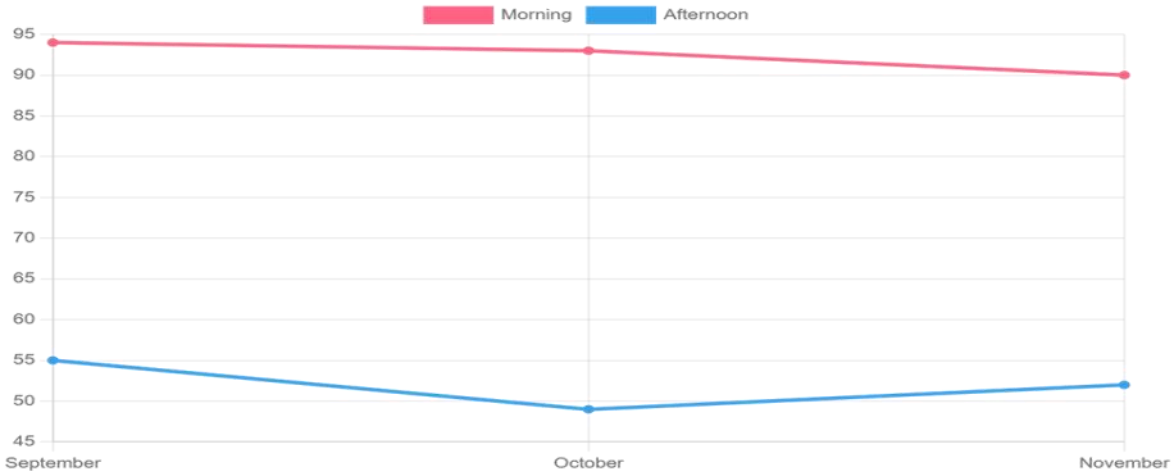


Figure 2 Average % Humidity

drop begins to occur, and the drop continues steadily until the final week of the sample's testing. A small spike in temperature occurs then, but nevertheless, this is significant for later conclusions. The indoor samples remained at a constant 70-degrees Fahrenheit, and the freezer samples remained at a constant 3-degree Fahrenheit.

Much like the predictions made, the samples mostly tested positive, however there was an outlier than can be observed below.

	Sept 19	Sept 26	Oct 03	Oct 10	Oct 17	Oct 24	Oct 31	Nov 07	Nov 14	Nov 21
Indoor Porous										
Indoor Nonporous										
Outdoor Porous										
Outdoor Nonporous										
Freezer Porous										
Freezer Nonporous										

Red – Negative *Green - Positive*

On the fourth week of testing, the outdoor porous sample tested negative. Due to the short amount of time it had been subjected to the elements, the sample was retested the next week and found to test positive.

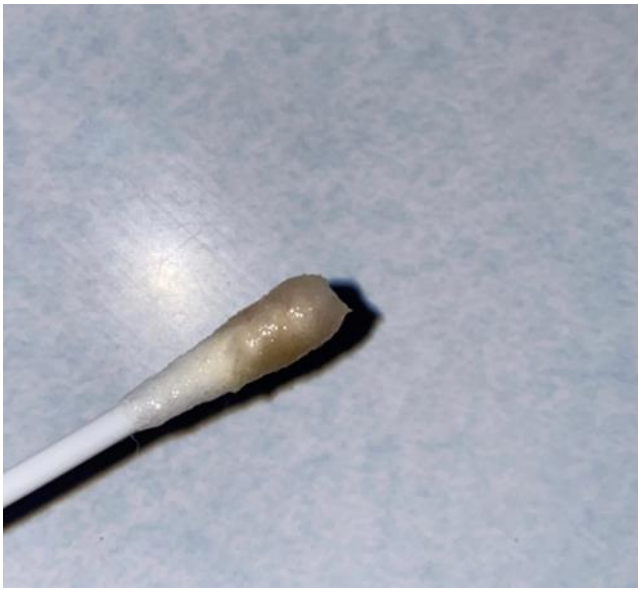


Figure 3 Negative Result - OCT 10

As can be seen, the test result is clearly negative. Two more tests were run immediately after to verify the result. Then another sample was tested the next week.

Figure 4 Positive Result - OCT 17

As seen above, the next week returned a positive result, albeit faint. The strong results seen in earlier testing are absent, possibly due to degradation of the sample. As found by Adam et al. (2011), blood loses 90% of its identifiable markers over a 30-day period in humid environments. The heme molecules needed for the reaction of the Kastle Meyer reagent test, however, are usually some of the last to go due to their constant production and retention in the blood (Ogun, Joy, & Valentine, 2021). The conclusion drawn here is that the outdoor sample in the porous material was already stretched thin due to the porous material absorbing and spreading the blood throughout its surface. This combined with 4 weeks of exposure to humidity led to the samples degrading. In this case, one sample tested degraded at a slightly faster rate than the others. Whether this is because of slightly more exposure to the elements or not can be questioned. The number of variables that could cause the sample to degrade at a faster rate than the others are countless. It is believed the only reason the other samples did not continue to lose their structure was due to the temperature shift around the time the degradation began to affect test results. The cooler climate preserved them. This would also explain why the sample tested negative once again after the temperature spike hit during the last week of testing. It can be reasonably inferred from this data that temperature can affect the rate at which a sample will degrade. In addition to the evidence already presented, the samples that were indoors, and in the freezer, never presented questionable results. The strength of the reaction remained consistent throughout the testing.

Figure 4 Positive Result - OCT 17

Another conclusion drawn would be the fact that the porous material influences the test result. The outdoor sample that tested negative was on the porous material. The outdoor, nonporous material never had a questionable test result. It always turned up positive. The nonporous materials also typically turned presented more vibrant reactions when positive. This is believed to be due to the inability for the blood sample to seep into the surface affecting its structure. The retention of its structure allows for the effective collection and testing of the sample. The more the sample is spread out and subjected to the elements, the more diluted it becomes. The Kastle-Meyer Reagent test used for this study is only sensitive up to 1:16 dilution (Casali, Ciavaglia, Gannicliffe, Lidstone, & Webster, 2020). Because of this, it would make sense for the porous materials to return weaker results.

Terminology

Alternate Light Source - a light source that can emit light at different wavelengths

Artificial - made or produced by human beings rather than occurring naturally, especially as a copy of something natural

Blood - the red liquid that circulates in the arteries and veins of humans and other vertebrate animals, carrying oxygen to and carbon dioxide from the tissues of the body

Chemiluminescence - the emission of light during a chemical reaction which does not produce significant quantities of heat

Cross Contaminate - transfer bacteria or other microorganisms unintentionally from one substance or object to (another), with harmful effect

False Negative - a test result which incorrectly indicates that a particular condition or attribute is absent

Fluorescence - the visible or invisible radiation emitted by certain substances as a result of incident radiation of a shorter wavelength such as X-rays or ultraviolet light

Degrade - break down or deteriorate chemically

Deoxyribonucleic Acid (DNA) - a self-replicating material that is present in nearly all living organisms as the main constituent of chromosomes. It is the carrier of genetic information

Dilute - make (a liquid) thinner or weaker by adding water or another solvent to it.

Kastle-Meyer test - a test run on blood that may confirm its presence; involves the use of a phenolphthalein solution and an oxidizing agent

Nonporous - not having minute spaces or holes through which liquid or air may pass

Pathogen - a bacterium, virus, or other microorganism that can cause disease

Porous - having minute spaces or holes through which liquid or air may pass

Citations

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Casali, F., Ciavaglia, S. A., Gannicliffe, C., Lidstone, N., & Webster, L. (2020). Validation of presumptive tests for non-human blood using Kastle Meyer and Hemastix reagents. Science & Justice: Journal of the Forensic Science Society, 60(1), 30–35. https://doi.org/10.1016/j.scijus.2019.10.003

MEET THE NEW

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Payments may be made online or mailed to

16743 Hwy 67

Biloxi, MS 39532

2023 CONFERENCE

The 2023 Conference will be held on the beautiful Mississippi Gulf Coast.

Exact date and location to be determined soon.

Stay tuned for future announcements, we can't wait to see you there!

Follow Us!

to stay up to date on all future announcements

MDIAI

Mississippi Division of the International Association for Identification

THANK YOU

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