Mississippi Forensic News

VOLUME 2 ISSUE 1 NOVEMBER 5, 2018

SPECIAL POINTS OF INTEREST:

- 2019 Keynote Speaker Information
- Member Spotlight!
- 1,2–Indanedione research results
- 2018 Conference Pics!

INSIDE THIS ISSUE:

2019 Conference Information!

Save the Date:

April 9th to April 11th, 2019

Topic:

Mass Casualties

Registration:

Seating is limited to 120 so register early to reserve your spot!

Registration Link:

https://www.mdiai.com/2019-conference

Keynote Speaker:

Mr. James Brinson

***See more info on page 3!**

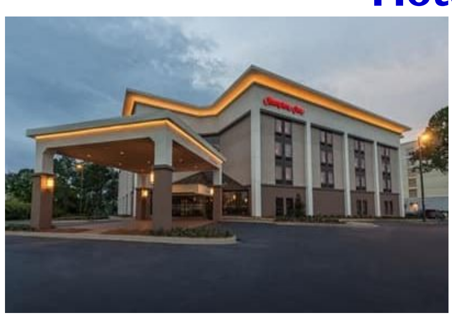
Conference Location:

Northeast Conference Center

111 US Hwy 11 & 80 at I-20/I-59

Meridian, MS 39301

Hotel:



Hampton Inn

103 US Hwy 11 and 80

Meridian, MS 39301

(601) 483-3000

Rate: $93/night until 3/19/19

Stay tuned :

http://www.mdiai.com/2019-conference

Learn about Meridian:

http://www.visitmeridian.com

From the President

"Our members are our family and we would love to grow our family even more this year!"

Greetings,

As a member of the Mississippi Division of the IAI for almost ten years and your newly elected President for 2018-2019, I am excited you have chosen to be a part of this wonderful organization. The MDIAI was established in 1980 as a means of bringing educational material to our members, and we continue to strive to do that today. We recently closed out our annual conference in Gulfport, MS and with everyone's help and attendance, it was a huge success. This year we are hoping to spread the word to all law enforcement and the forensic science community about the MDIAI and how they can become a part of this superb group of professionals. Our website, mdiai.com, says it best when it states, "Our members are our family", and we would love to grow our family even more this year! We need your help to do this! I would love for each and every one of our members to spread the word to your friends and co-workers about the MDIAI and how our educational seminars can help keep you up to date on your required hours needed for training.

This year we have already started planning for our annual training conference for 2019 which will be held in Meridian, MS, April 9th through 11th. This conference is going to focus on what is involved when we are asked to respond and investigate a mass casualty event. We are working on obtaining nationally recognized speakers and if you would like to stay up to date with the ongoing developments, I encourage you to go to our website www.mdiai.com . There is even a link you can click to sign up for our mailing list. I am looking forward to an exciting year and hope that you may decide that this is your year to join us in planning future conferences, serving actively as a board member or just spreading the word to others about the MDIAI and what it has to offer. As an organization, we welcome any suggestions, questions or comments and all officers contact information can be located on our website. I hope you are as excited as I am about the 2019 Conference in Meridian, and I can't wait to see you there!

Lauren G. Smith
MDIAI President
2018-2019

2019 Keynote Speaker— James Brinson

Mr. Brinson is a Counter –Terrorism Expert, with an emphasis in Weapons of Mass Destruction (WMD) and Terrorism Tactics.

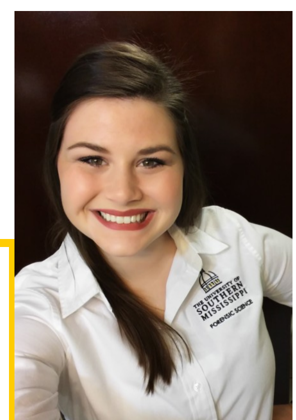
Mr. Brinson has been in his career field for 25 years and is a Specialist in Terrorism and Chemical, Biological, Radioactive, Nuclear and Explosive (CBRNE) Weapons of Mass Destruction. Mr. Brinson is an instructor in active shooter preparedness and response, training military, law enforcement and civilians in responding to and surviving active shooter type attacks. Prior to working for the Mississippi Office of Homeland Security, Mr. Brinson worked for the U.S. Air Force where he responded to some of the most notorious terrorist incidents in modern history. He oversees the protection of the State of Mississippi's Critical Infrastructure, conducts training for major sporting events on security measures and trains law enforcement agencies across the state in various counterterrorism areas. Mr. Brinson presents at many local, state, national and international audiences on his unique knowledge.

Mr. Brinson is employed as the Director of Operations for the Mississippi Office of Homeland Security and The FBI Joint Terrorism Task Force. He has been employed there since 2004. Responsibilities include managing response assets for WMD related responses, oversees active shooter preparedness and training program for Mississippi, along with State Search and Rescue (SAR) operations, as well as being a sworn law enforcement officer that also works cases that are either potentially or actually terrorism-related.

"Mr. Brinson is a Counter–Terrorism Expert with an emphasis in Weapons of Mass Destruction"

Member Spotlight! Kaylee Sanders

Kaylee Sanders is from Natchez, MS and recently earned her Bachelor of Science in Forensic Science with an emphasis in Biological Sciences from The University of Southern Mississippi. During her time at USM, Kaylee served as the MDIAI Chairperson on the Forensic Science Society's executive board, completed an internship with the Harrison County Sheriff's Department Crime Scene Unit, worked part-time as a Correctional Officer at Forrest County Jail, and completed a field study with the USM School of Criminal Justice. She was a recipient of the Luckyday Citizenship Scholarship, which required that she complete over 160 hours of community service and maintain a high GPA throughout school. Since graduating, Kaylee has pursued careers in North Carolina, Virginia, Texas, and several locations in Mississippi. She aspires to work in the field to gain experience as a Crime Scene Investigator before working in a crime lab as a DNA analyst.



Kaylee correctly answered the Forensic Challenge Question in the last edition!

An investigation of three 1,2-indanedione formulations observed and compared at 24 hours, 72 hours, and 5 days

By Kelli Sharp and Jennifer Smith

Abstract

In this study, three known 1,2-indanedione formulations were explored, and observed at three different development times. All fingerprint samples were treated using the spray method and were examined by an alternate light source (ALS). The primary objective of this experiment was to compare and identify an optimal formulation for latent print development at various time periods. The best results were achieved with a 1,2-indanedione solution containing: 1,2-indanedione (0.75g), ethyl acetate (35mL), ethanol (0.5mL), zinc chloride (0.02g), HFE-7100 (450mL) and dichloromethane (15mL).

1. Introduction

1,2-indanedione has recently become a widely accepted latent print development method within the forensic science community. It is a popular reagent used in law enforcement because of potential advantages over 1,8-diazafluoren-9-one. Overall, 1,2-indanedione proved to be a viable alternative to traditional methods for the detection of fingermarks on porous surfaces, with more fingermarks being developed using this reagent on real samples than both DFO and ninhydrin and a combination of the two reagents [1]. 1,2-indanedione is used to test for latent fingerprints on porous surfaces and is typically mixed with zinc chloride to enhance the luminosity of the developed fingerprint [2]. Latent prints developed with 1,2-indanedione are viewed with an Alternate Light Source (ALS) at a wavelength of 515 nm. Since its introduction in the mid-1990's, there have been numerous studies on the effectiveness of 1,2-indanedione; however, the chemical formulations varied among each study [1, 3, 4]. In addition, the optimal development periods have differed. The technical procedure for the research-validated formula of 1,2-indanedione-zinc at the North Carolina State Crime Laboratory states that the item of evidence should be allowed to develop over time until latent impressions develop [5]. Based on this technical procedure, it was decided that a twenty-four hour development time should be tested. The seventy-two hour development period was found in a study performed by Wiesner et al. [4]. The five-day development period is suggested by the NIJ Fingerprint Sourcebook [2]. The purpose of this study was to test these three formulations and compare the results at three different time periods.

2. Materials and Methods

Fifty-four latent fingerprints were collected from seven North Carolina State Crime Laboratory employees and interns. Eighteen fingerprints were used for each of the three formulations and were deposited on white Domtar Husky copy paper. For each of the three formulations, the samples were divided into three groups, each representing a different development time (Figure 1). Each section of paper contains the right thumb print of one test subject. Restrictions for applying the fingerprint samples were: only right thumb prints, rub either the side of the nose or behind the ear for fingerprint residue collection, apply pressure to the paper evenly and within the brackets, and for a duration of three seconds.

All samples were treated using the spray method (Sirchie aerosol cans) under a fume hood. Prior to treatment of samples, a self-made test print was produced for each formulation. Samples were then placed on a piece of cardboard to air dry. All latent prints were viewed with the Mini-CrimeScope® Advance Forensic

Light Source (SPEX Forensics) at 515 nanometers after each respective development period. Photos were taken before treatment and within thirty minutes after development with a Nikon D810. Humidity and temperature ranges were recorded during each development time with an AcuRite Humidity Monitor by Chaney Instrument Company – Model 00325 (Table 1). After treatment, samples were observed after three different development times: twenty-four hours, seventy-two hours, and five days (Table 2). Upon completion, all fifty-four fingerprint samples were given a rating (0-4) based on overall ridge detail and clarity.

2.1. 1,2-Indanedione Formulations

1. North Carolina State Crime Laboratory Method (Formula 1): A Zinc Chloride stock solution was made by placing 0.4 grams of zinc chloride powder (Fisher Scientific) and a magnetic follower into a 500 mL beaker. 10 mL of ethanol (Fischer Scientific), 1 mL of ethyl acetate (Fisher Scientific) and 190 mL of HFE-7100 (Sirchie) were added to the solution while stirring. The solution was then stirred for an additional five minutes. The resultant solution was transferred to a clean, dark, shatterproof container (Nalgene). A working solution was made by placing 0.8 grams of 1,2-indanedione powder (Sirchie) into a 1500 mL beaker with a magnetic stirrer. 90 mL of ethyl acetate (Fisher Scientific), 10 mL of glacial acetic acid (Fisher Scientific), 80 mL of the zinc chloride stock solution, and 820 mL of HFE-7100 (Sirchie) were added to the solution while stirring. The mixture continued to stir until the 1,2-indanedione powder was completely dissolved. The resultant solution was transferred to a clean, dark, shatterproof container (Nalgene) [5].

2. Patton et al. Method (Formula 2): 0.75 grams of 1,2-Indanedione were placed into a 1000 mL beaker with a magnetic stirrer. 35 mL of ethyl acetate (Fisher Scientific), 0.5 mL of ethanol (Fisher Scientific), 0.02 grams of zinc chloride (Fisher Scientific), 450 mL of HFE-7100 (Sirchie) and 15 mL of dichloromethane (Fisher Scientific) were added to the solution while stirring. The mixture continued to stir until the 1,2-indanedione powder was completely dissolved. The resultant solution was transferred to a clean, dark, shatterproof container [3].

3. Wallace-Kunkel et al. Method (Formula 3): 1 gram of 1,2-Indanedione was placed into a 1000 mL beaker with a magnetic stirrer. 10 mL of acetic acid (Fisher Scientific) and 90 mL of ethyl acetate (Fisher Scientific) were added to the solution while stirring. 900 mL of HFE-7100 were used as the carrier solvent and added to the solution to make 1 L [1].

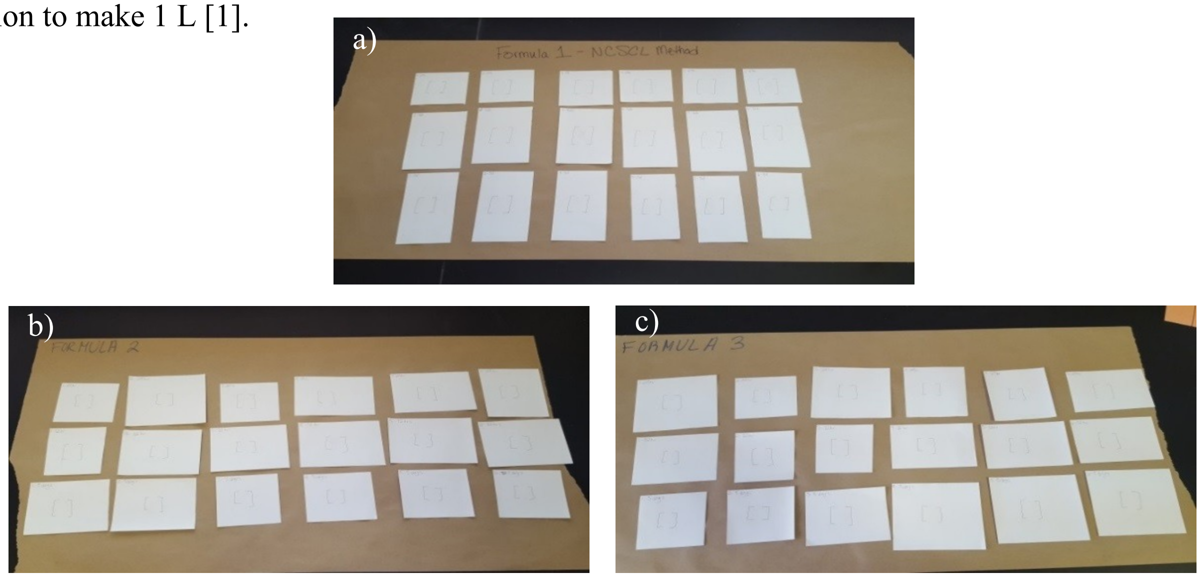


Figure 1

Experimental layout of samples where (a) is Formula 1; (b) is Formula 2; (c) is Formula 3.

Environmental Conditions		
	Temperature Range (Low/High)	Humidity Range (Low/High)
24 Hour Development Time	70˚F/72˚F	76%/77%
72 Hour Development Time	70˚F/73˚F	50%/75%
5 Day Development Time	70˚F/72˚F	68%/79%

Table 1
Range of environmental conditions during each development time.

24 Hour Development Experiment		
	Date Applied	Date Observed
Formula 1	6/19/17	6/20/17
Formula 2	6/19/17	6/20/17
Formula 3	6/19/17	6/20/17
5 Day Development Experiment		
	Date Applied	Date Observed
Formula 1	6/21/17	6/26/17
Formula 2	6/21/17	6/26/17
Formula 3	6/21/17	6/26/17
72 Hour Development Experiment		
	Date Applied	Date Observed
Formula 1	6/26/17	6/29/17
Formula 2	6/26/17	6/29/17
Formula 3	6/26/17	6/29/17

Table 2
Application and observation dates.

3. Results and Discussion

Developed samples were given an overall rating based on the amount of ridge detail, overall clarity of the print, how much pattern area was visible, and the amount of fluorescence observed (Table 3, Table 4). The level of fluorescence was noted because it exhibits the effectiveness and longevity of each formula. Example photos for each rating can be found in Figure 2. A Certified Latent Print Examiner at the North Carolina State Crime Laboratory analyzed all developed prints and was also consulted with regard to the rating system (Table 3).

Rating	Description
0	No development/fluorescence
1	Minimal fluorescence noted; level 1, but no level 2 detail present
2	Development/fluorescence noted; level 1 and level 2 detail present; not sufficient for comparison
3	Development/fluorescence noted; level 1 and level 2 detail present; sufficient for comparison; smudging/distortion noted
4	High level of development/fluorescence noted; level 1 and level 2 detail present; sufficient for comparison; little to no smudging/distortion

Table 3
Devised five-point scale for fingerprint sample rating.

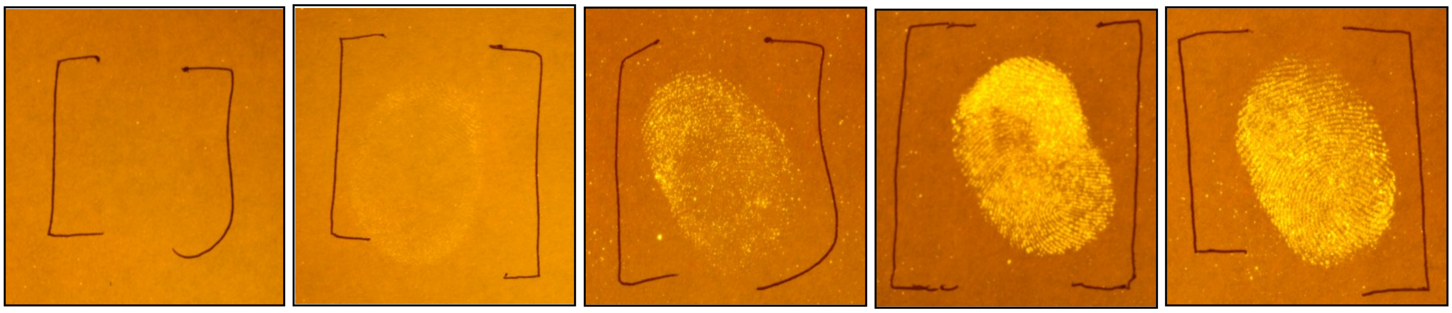


Figure 2
Examples of each rating (a) equals a rating of zero; (b) equals a rating of one; (c) equals a rating of two; (d) equals a rating of three; (e) equals a rating of four. Photos were taken immediately after development.

3.1. Formula 1 Results

As shown in Figure 3, the twenty-four hour development time appears to be the optimal development period for Formula 1. After seventy-two hours and five days, the efficacy of the formulation declined as the developed prints began to fade. Sample 1, with a development time of twenty-four hours, displayed no results possibly due to a lack on fingerprint residue deposited on the paper. The formula remained fluid in the glass container for the entirety of the experiment. It was clear in color, but after two days some ingredients of the formula developed a film on the inside of the container. This could have had an impact on the results for the seventy-two hour and five day development times.

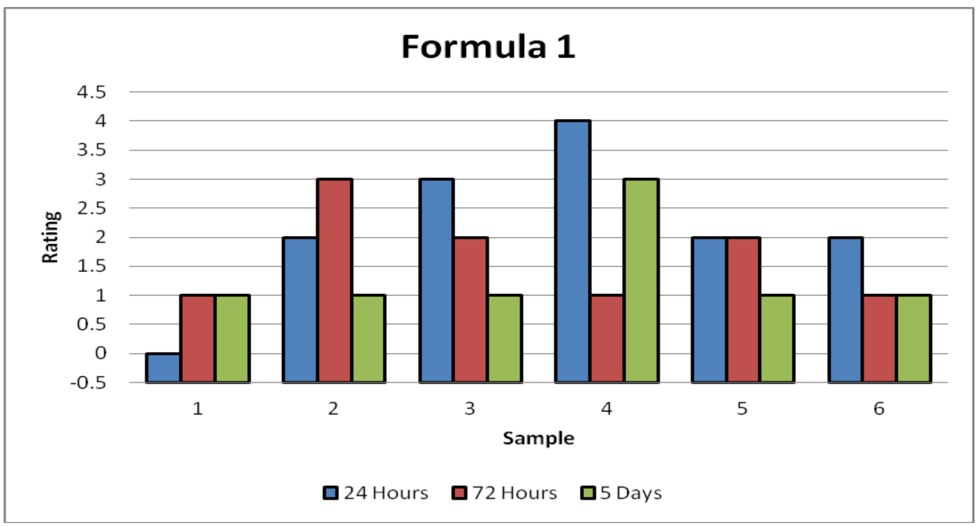


Figure 3
Formula 1 results for each development time

3.2. Formula 2 Results

Although Patton et al. used the dry contact method as their mode of application, it was stated that an acid free formula performed best in comparison to other solutions [3]. On average, the ratings for Formula 2 were higher at each development time in comparison to the other formulas. The few samples that had a rating from 0-1 could have resulted from a lack of fingerprint residue or other environmental or physical factors. Formula 2 did not fade noticeably over the longer development times and was found to be the most durable. Most samples were seemingly unaffected by the development time periods; having displayed intact ridge detail and fluorescence over the course of the study. Formula 2 had a fluid consistency and a clear, yellow appearance. The formula did not dissociate throughout the duration of the experiment.

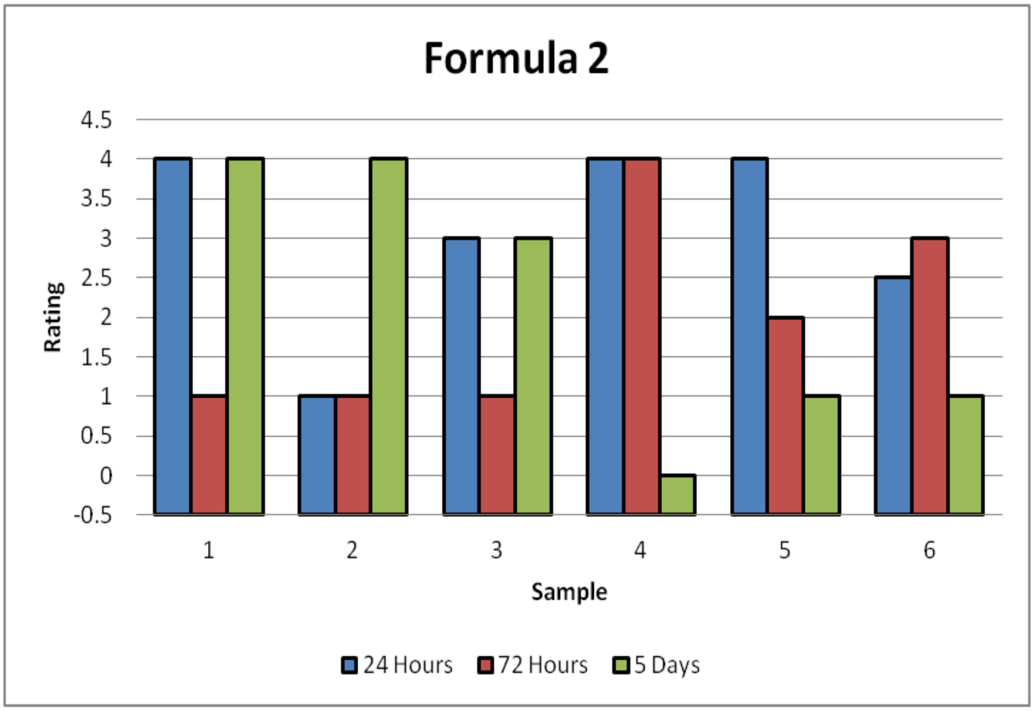


Figure 4
Formula 2 results for each development time.

3.3. Formula 3 Results

According to Wilkinson et al. and Wiesner et al., as referenced in *The Fingerprint Sourcebook* (pp 7-20, 7-21), it is not recommended to use alcohol when mixing 1,2-indanedione solutions [2]. Like DFO, indanedione forms a hemiketal with methanol; however, unlike DFO, this hemiketal is more stable than the parent compound and thus its formation prevents the reaction with amino acids. Because 1,2-indanedione is completely converted to the less sensitive hemiketal, some suggest that alcohols should be avoided in any indanedione formulations [2]. Even though it is recommended that alcohol not be used, Formula 3 produced poor results in comparison to other formulas used. The solution dissociated after a two-day period, creating a clumpy consistency. None of the samples produced a significant amount of ridge detail or significant fluorescence.

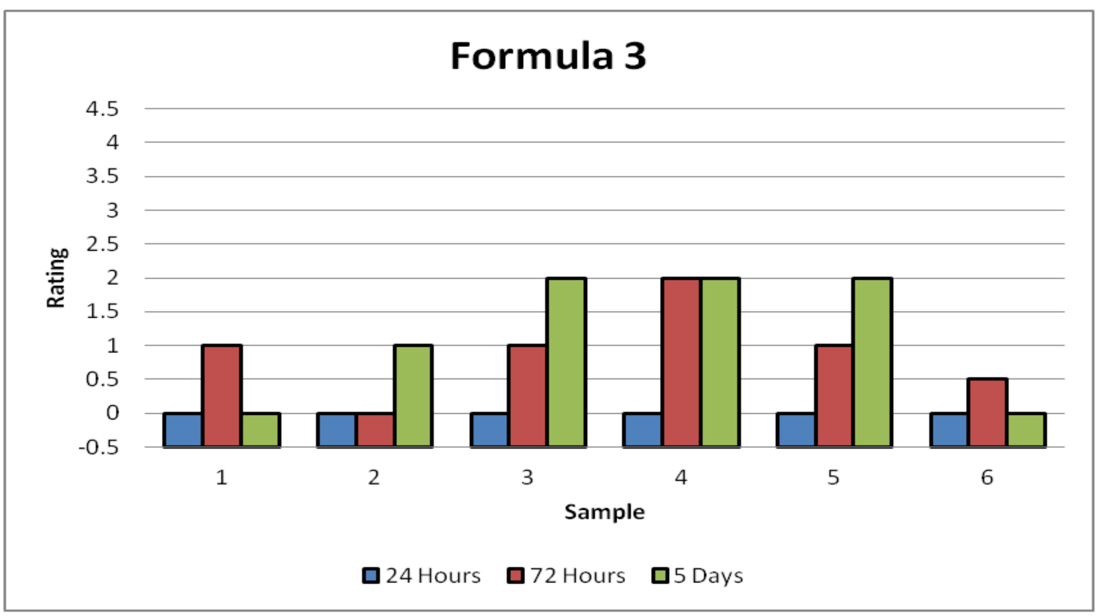


Figure 5
Formula 3 results for each development time.

3.4. Overall Results

Upon review of data, it was determined that Formula 1 produced optimal results after a twenty-four hour development time (Figure 3, Figure 6). When subject to a drying period longer than twenty-four hours, the formula began to fade. Formula 2 was found to perform best at the twenty-four hour development time. The intensity and durability of this formula set it apart from the other two formulations tested. Formula 3 gave the most unfavorable results (Figure 5, Figure 6). This could have been due to the lack of alcohol in its formulation. According to Wallace-Kunkel et al., the optimal method of development is to heat in a heat press at 165˚C for 10 s, without steam, and to view results using the Polilight, with excitation at 530 nm and observation using an OG590 long pass filter [1]. Heat was not used as method of development in this investigation, which may have been a necessary step for the formula to develop the prints successfully. In order to keep the conditions of this experiment consistent, it was decided to use a simple mode of application and development. Heat was not used as a variable because of its potential to damage the samples. After thorough analysis, it was determined that Formula 2 performed the best out of the three formulations.

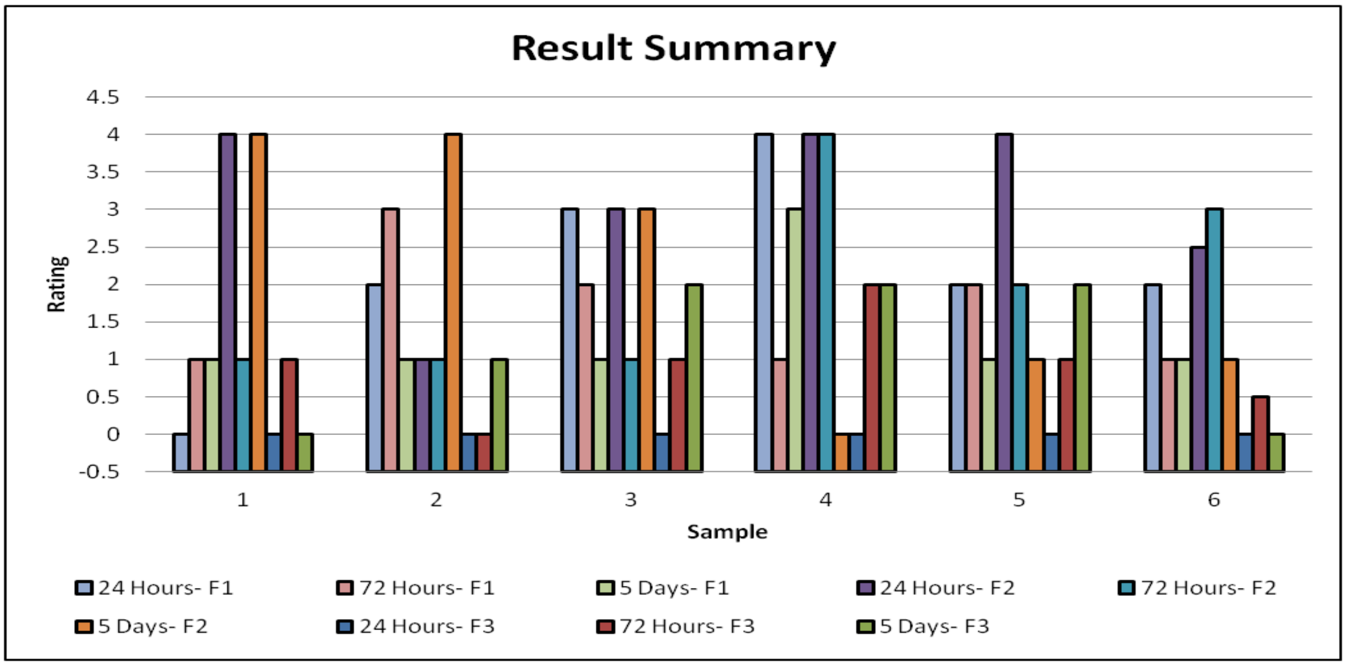


Figure 6
Overall results.

24 Hour Development Ratings						
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Formula 1	0	2	3	4	2	2
Formula 2	4	1	3	4	4	2.5
Formula 3	0	0	0	0	0	0
72 Hour Development Ratings						
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Formula 1	1	3	2	1	2	1
Formula 2	1	1	1	4	2	3
Formula 3	1	0	1	2	1	0.5
5 Day Development Ratings						
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Formula 1	1	1	1	3	1	1
Formula 2	4	4	3	0	1	1
Formula 3	0	1	2	2	2	0

Table 4
Ratings for all development times.

4. Conclusion

The intent of this experiment was to compare and identify an optimal formulation of 1,2-indanedione for latent print development. Three different 1,2-indanedione formulations were chosen and subject to three different development times. All fingerprint samples were examined by an ALS and documented with photography. Prints were then given a rating based on their ridge flow and clarity. Formula 1 performed optimally at the twenty-four hour development time. Formula 2 performed exceptionally well at all development times. This formula produced superior prints which mostly all possessed clear ridge detail and striking fluorescence. Formula 3 produced inconclusive results and therefore, did not have an optimal development time. It was found that this formula does not develop well without the use of a heat press, as suggested by Wallace-Kunkel et al. [1]. Upon conclusion of this experiment, it was determined that any development time longer than seventy-two hours would be nonproductive and could potentially lead to inferior results. This study was performed because of numerous discrepancies found in the literature relating to the optimal development time period and formulation of 1,2-indanedione. This research could help find a solution to this issue and lead to more identifiable fingerprints being developed on evidence.

5. References

[1] Wallace-Kunkel, Christie, Chris Lennard, Milutin Stoilovic, and Claude Roux. "Optimisation and Evaluation of 1,2-indanedione for Use as a Fingermark Reagent and Its Application to Real Samples." *Forensic Science International* 168.1 (2007): 14-26.

[2] Holder, Eric Himpton, Laurie O. Robinson, and John H. Laub. *The Fingerprint Sourcebook*. Washington, DC: U.S. Dept. of Justice, Office of Justice Programs, National Institute of Justice, 2011.

[3] Patton, Emma L.T., David H. Brown, and Simon W. Lewis. "Detection of Latent Fingermarks on Thermal Printer Paper by Dry Contact with 1,2-indanedione." *The Royal Society of Chemistry* 2.6 (2010): 631.

[4] Wiesner, Sarena, Eliot Springer, Yoel Sasson, and Joseph Almog. "Chemical Development of Latent Fingerprints: 1,2-Indanedione Has Come of Age." *Journal of Forensic Sciences* 46.5 (2001): 1082-1084.

[5] North Carolina State Crime Lab Technical Procedure for 1,2-indanedione-zinc. Version 1. Issued by Digital/Latent Forensic Scientist Manager. Effective Date: 8/29/2014.

6. Acknowledgements

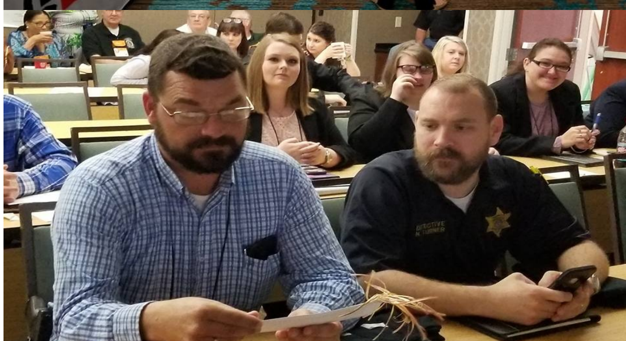
The authors would like to give thanks to the Latent Evidence Section of The North Carolina State Crime Laboratory for providing all materials and resources to make this a successful research project. Also, a special thanks to Christopher Cavazos in the Latent Evidence Section for providing guidance and support throughout the course of this study.

For further information, please contact:

Kelli Sharp
Department of Forensic Science
The University of Southern Mississippi
kelli.sharp@usm.edu

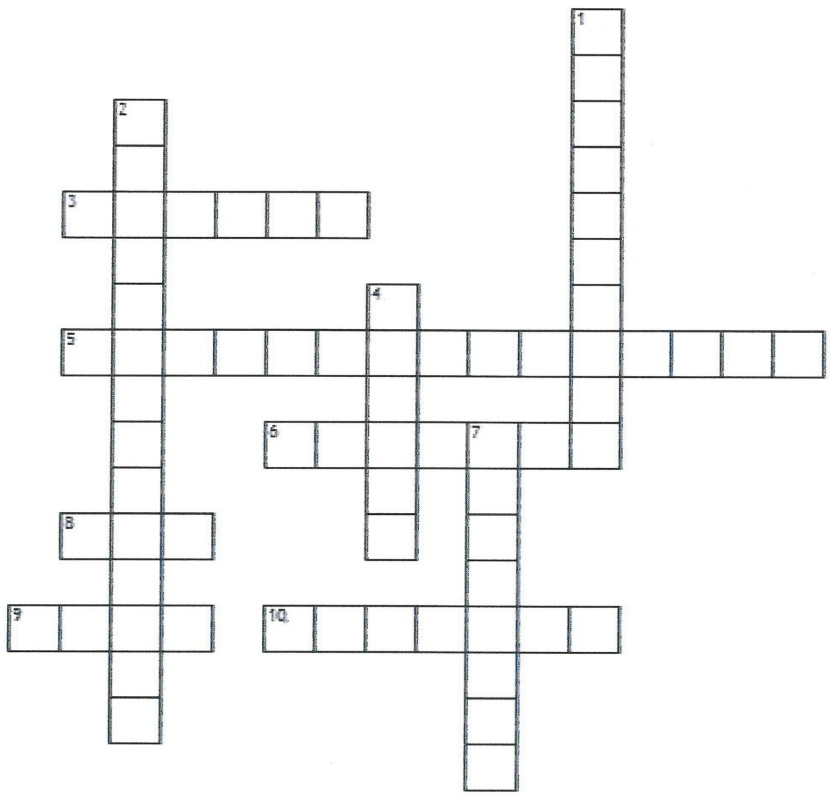
Jenni Smith
Department of Biological and Biomedical Sciences
North Carolina Central University
jsmit419@eagles.nccu.edu

2018 Conference Fun!



Forensic Science Fun!

Forensic Science Rocks!



Across

3. An invisible print left on an object by chance

5. The application of all sciences to the field of criminal justice

6. Someone who saw the crime occur.

8. A person trained to record, collect, and test evidence left behind at a crime scene

9. The most common fingerprint pattern type

10. Someone thought to have committed the crime

Down

1. The science of projectiles and firearms

2. The documentation of where evidence is from the time it is collected

4. The person the crime happened to

7. Any item collected in reference to an investigation