



2024 GRADUATE RESEARCH SYMPOSIUM

Forensic Science & Law

APRIL 4TH-5TH



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If you wish to join in person:

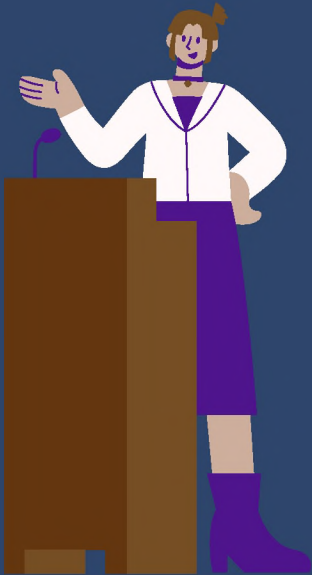
Join us at:

Duquesne University in Pittsburgh, PA.

The symposium will be held in:

Wolfe Lecture Hall Bayer.

(The furthest building on Academic Walk)



If you wish to join via ZOOM:

Click this link to join:

[https://duq.zoom.us/j/98288391005?
pwd=c011dS90REYvZm5mK3RabVVBSm5
ZQT09](https://duq.zoom.us/j/98288391005?pwd=c011dS90REYvZm5mK3RabVVBSm5ZQT09)

Meeting ID: 982 8839 1005

Passcode: forensic





DAY ONE - THURSDAY, APRIL 4TH, 2024

Wolfe Lecture Hall Bayer

9:00 AM - 5:00 PM

9:15 AM- Conducting A Psychiatric Analysis using Collateral Materials: A Case Study of Theodore Kaczynski

Rebekka Range

9:45 AM- Using an Indirect Personality Assessment of Timothy McVeigh to Determine Psychopathy

Mackenzie Miller

10:15 AM- The Effects of Fingerprint Development Techniques on Forensic Cartridge Case Identification

Sasha Valentino

10:45 AM

BREAK

11:00 AM- Identification of Biomarkers Associated with Prolonged Starvation in Cat (*Felis catus*) Bones

Annagrace Radocaj



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DAY ONE - THURSDAY, APRIL 4TH, 2024

Wolfe Lecture Hall Bayer

9:00 AM - 5:00 PM

Continued

11:30 AM- Cognitive Bias Mitigation Techniques: Overcoming Barriers and Finding Solutions

Taylor Hopkins

12:00 PM- Impacts of Desiccants on DNA Quantity and Quality in Sexual Assault Kits Over One Year

Catherine Hull

12:30 PM

Lunch

1:45 PM- The Recovery of Human DNA in an Aqueous Environment Using Novel Technology

Halle Saf

2:15 PM- Analysis of the Transfer of Drugs to the Envelope in Mail Over Time and Varying Conditions

Madison Eidemueller

2:45 PM- A Landscape Study: Examining Trends in Serial Killers Raised by Non-biological Parents

Amanda Piccirilli

Forensic Science & Law



DAY ONE - THURSDAY, APRIL 4TH, 2024

Wolfe Lecture Hall Bayer

9:00 AM - 5:00 PM

Continued

3:15 PM- Identifying the Presence of Semen Through the Detection of Fructose

Taylor M. McClure

3:45 PM

BREAK

4:00 PM- The Extraction and Subsequent Analysis of Gel Pen Ink

Elizabeth Knittle

4:30 PM- Analysis of Drug Content Distribution on Paper using both Soak and Spray Methods by Gas Chromatography-Mass Spectrometry (GC-MS)

Aizlynn Michel

5:00 PM- A Comparison of DNA Yield from Cotton and Nylon Swabs in Simulated Sexual Assault Samples

Sylvia Hamilton

END OF DAY ONE



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DAY ONE - THURSDAY, APRIL 4TH, 2024

Wolfe Lecture Hall Bayer

Abstracts:

Rebekka Range
9:15 AM

Conducting A Psychiatric Analysis using Collateral Materials: A Case Study of Theodore Kaczynski

Competency to stand trial and sentencing are both factors impacted by the results of a mental health evaluation. Currently, these evaluations utilize interviews with the defendant to answer the question of their mental state. In cases of Fifth Amendment invocations, these individuals do not have to speak with the mental health expert and a method of analysis that does not require the interview becomes necessary. A case study of Theodore Kaczynski has been used to develop such a method, specifically with documents. These documents are being compared to the diagnostic criteria found in the DSM-5 (2013) as well as the PDM-2 (2008) to determine if a potential diagnosis can be reached. This research will impact the forensic science and legal community by presenting a method to assess mental health disorders when an individual invokes their Fifth Amendment rights and refuses to participate in psychological evaluations.

Committee Members: Lyndsie Ferrara, Ph.D.; Hannah Stokes, Ph.D.; John Cencich, J.S.D.; Pamela Marshall, Ph.D.

Mackenzie Miller
9:45 AM

Using an Indirect Personality Assessment of Timothy McVeigh to Determine Psychopathy

On April 19 of 1995, the Alfred P. Murrah Federal building was bombed by Gulf War Veteran Timothy McVeigh using a cocktail of ammonium nitrate, racing fuel and other chemicals. This research aimed to analyze the life of McVeigh to determine if he exhibited psychopathic behaviors. An indirect personality assessment was used to analyze McVeigh. The IPA analyzes both unconscious and conscious feelings/motives of the individual through interviews of themselves and those around them. Because McVeigh was executed in June 2001, the main source of material used is a series of interview tapes collected by Lou Michel and Dan Herbeck. These interviews were transcribed into McVeigh's biography, *American Terrorist: Timothy McVeigh and the Oklahoma City Bombing*. McVeigh's behaviors, and the inflection of emotion in his voice, were used to complete this assessment. This research hopes to further the application of the IPA method in relation to deceased individuals.

Committee Members: John Cencich, J.S.D.; Lyndsie Ferrara, Ph.D.; Pamela Marshall, Ph.D.

Sasha Valentino
10:15 AM

The Effects of Fingerprint Development Techniques on Forensic Cartridge Case Identification

When a fired cartridge case comes into a forensic science laboratory there are various pathways it can go to be analyzed. The more frequent process is done by the fingerprint section followed by the firearm section, if at all. This is due to there not being a standard in place in all forensic laboratories. The purpose of this research is to determine what effects certain fingerprint development techniques have on cartridge cases and if they impact cartridge case comparisons. Brass, steel and aluminum cartridge cases in both 9mm and .45 calibers were processed using cyanoacrylate fuming, gun blue, basic yellow 40, black powder and a sequence of these techniques. It was determined that gun blue and the sequence of techniques have a negative effect on comparisons. Acetone, alcohol wipes and soapy water all performed about equally in cleaning the cartridge cases.

Committee Members: Missy Meredith, M.S.; Sarah Varhola, M.S.; Stephanie Wetzel, Ph.D.; Lyndsie Ferrara, Ph.D.

Annagrace Radocaj
11:00 AM

Identification of Biomarkers Associated with Prolonged Starvation in Cat (*Felis catus*) Bones

In incidents of hoarding animals, starvation or emaciation of the animal is not uncommon. In the late stages of decomposition, little to no tissue is present, and only depleted bone samples can be collected from the victim. Bone turnover markers, such as N-terminal cross-linking telopeptides of type I collagen, increase due to heightened bone resorption. This research aims to investigate the correlation between the N-telopeptide concentrations and starvation through the matrix of bone. Immunoassay testing of starved and non-starved feline serum was performed and analyzed as a proof-of-concept study. Once obtained, the presumably starved and non-starved bone samples were ground into a fine powder, followed by a protein extraction. The extracted samples were then subjected to immunoassay testing. The results indicated that in serum, the N-telopeptide concentration of the starved samples tended to be higher. However, further testing will be conducted to determine N-telopeptide concentrations in bone samples.

Committee Members: Becky Morrow, DVM; Michael Cascio, Ph.D; Lisa Ludvico, Ph.D.; Lyndsie Ferrara, Ph.D.

Taylor Hopkins
11:30 AM

Cognitive Bias Mitigation Techniques: Overcoming Barriers and Finding Solutions

Forensic science practitioners are tasked with maintaining a stance of neutrality in the court of law. However, cognitive bias can unintentionally undermine this neutrality. The National Academy of Sciences report provided recommendations to strengthen the forensic science field, including a call for more research on bias, its impact on practitioners, and solutions to help remedy its effects. Since this report, some literature has provided potential solutions to reduce the risk of bias in the laboratory. However, these solutions are not widely implemented. This project gathered input from over 50 professionals to investigate the specific barriers forensic laboratories face when looking to implement bias mitigation techniques. While most participants answered affirmatively to the need for such techniques, barriers including lack of knowledge, support, and resources make implementation difficult. Overall, participant responses revealed relevant information that can help the field better understand current stances and future steps regarding bias in forensic science

Committee Members: Mandy Tinkey, M.S.; Sandra Sachs, Ph.D.; Lyndsie Ferrara, Ph.D.

Catherine Hull
12:00 PM

Impacts of Desiccants on DNA Quantity and Quality in Sexual Assault Kits Over One Year

Finding the ideal collection and storage process is crucial to maintaining the quality and quantity of DNA. A desiccant-based collection kit, manufactured by Gentueri, and a non-desiccant-based collection kit, used by the Pennsylvania State Police, were used to make contrived sexual assault samples. The sexual assault samples were stored for up to 12 months, at room temperature and 4 °C to determine which kit better preserved the quantity and quality of DNA in the samples. The results indicated that there were no noticeable differences between the two kits between months 4 through 6. In month 7 when the Gentueri Sexual Assault Kit appeared to perform better than the Pennsylvania State Sexual Assault Kit. There were no noticeable differences between the different storage temperatures. The study could be expanded to different states with different climates to achieve a more standardized procedure for collecting sexual assault kits across the United States.

Committee Members: Randy Nagy, B.S.; Dana Voris, M.S.; Lyndsie Ferrara, Ph.D.; Pamela Marshall, Ph.D.

Halle Saf
1:45 PM

The Recovery of Human DNA in an Aqueous Environment Using Novel Technology

This research intends to implement a novel method of human detection in aqueous environments to assist in missing persons cases. During this study, a tissue sample was submerged at a depth of 3 ft in a pond located in Kane, PA. Tissue was also placed within a control chamber to understand the impact of environmental conditions. Water samples were collected at 0 ft, 3 ft, 6 ft, 9 ft, and 12 ft from the tissue sources every week for two months. A novel Microbubble technology from Akadeum Life Sciences was used to extract the DNA from the collected water samples. Samples were quantified and the highest quality and least degraded samples were amplified and genotyped. Overall low quantities of DNA were recovered, but the Microbubble extraction kit yielded some partial DNA profiles. Continued research regarding detection of DNA in water may prove critical in missing persons investigations involving aqueous environments.

Committee Members: Samantha Border, M.S.; Lyndsie Ferrara, Ph.D.; Lisa Ludvico, Ph.D.; Pamela Marshall, Ph.D.

Madison Eidemueller
2:15 PM

Analysis of the Transfer of Drugs to the Envelope in Mail Over Time and Varying Conditions

As the drug abuse epidemic continues, more individuals who suffer from substance abuse disorders are ending up in the prison system, and more drugs are being smuggled into prisons. A common smuggling method is the "soak" method, where pieces of paper are soaked in a solution containing illicit substances, placed in envelopes, and sent to the prison as mail. Using surrogate drugs, this research aimed to determine how much substance transfers from the substance-soaked paper to the envelope. White computer paper was dipped in a 3.33 mg/mL solution of the substance dissolved in rubbing alcohol and placed in either white or manila envelopes. These envelopes were then allowed to sit for varying time frames or were sent in the mail. The samples were extracted and analyzed using Gas Chromatography-Mass Spectrometry. Results show that the short-term samples had the highest transfer, and white envelopes had more transfer than manila.

Committee Members: Christopher Merrill, M.S.F.S, D-ABC; Erica Maney, M.S.; Matthew Regentin, M.S.; Stephanie Wetzel, Ph.D.

Amanda Piccirilli**2:45 PM****A Landscape Study: Examining Trends in Serial Killers Raised by Non-biological Parents**

While serial killers can be found everywhere in the world, they became increasingly prevalent in the United States beginning in the 1960s. According to the FBI, a serial killer is someone who kills two or more people at various times. Example motives include anger, pleasure, money, and attention seeking. Using the Radford/FGCU Serial Killer Database, trends in serial killers who were adopted, placed in foster care, or raised by family members other than their biological parents were examined. Out of 500 serial killers active between 1965 to 2016, 9.8% were raised by their non-biological parents. Factors such as demographic, childhood, and criminal background information were examined. This study illustrated trends and numerical data within the population of serial killers raised by non-biological parents. This will be useful to further research on a subset of American serial killers and to provide resources to law enforcement and researchers using the database.

Committee Members: Colleen Fitzpatrick, Ph.D.; Lyndsie Ferrara, Ph.D.; Pamela Marshall, Ph.D.

Taylor M. McClure**3:15 PM****Identifying the Presence of Semen Through the Detection of Fructose**

Seminal fluid is among the most valuable sources of biological evidence which can be recovered from a crime scene. Current testing methods for seminal fluid, such as the prostate-specific antigen (PSA) test and microscopic examination for spermatozoa, are non-comprehensive and have a high potential for false positive or false negative results. Fructose is a naturally occurring sugar found in high abundance in semen. There is currently no detection method for seminal fluid utilizing fructose as the target molecule. However, quantification of fructose in seminal fluid may aid in the identification of such samples, forming an alternative method to PSA testing. We developed an optimized version of the colorimetric resorcinol method for fructose quantification. This method was then tested on normospermic and vasectomized seminal fluid samples and various other bodily fluids to determine fructose concentrations in these samples and evaluate the feasibility of this novel identification method for forensic applications

Committee Members: Emily Chadwick, M.S.; Pamela Marshall, Ph.D.; Michael I. Jensen-Seaman, Ph.D.

Elizabeth Knittle**4:00 PM****The Extraction and Subsequent Analysis of Gel Pen Ink**

Document examination evidence yields important results. One type, ink, can be separated and identified as evidence. There are multiple existing methods of analysis for ballpoint ink. A common method of analysis involves Thin-Layer Chromatography, TLC, which employs the use of a stationary and mobile phase to separate the components of a sample. Conversely, Gel ink is very complex making it difficult to analyze. There have been attempts to extract gel ink, with little success. Gel ink analysis using ballpoint ink extraction methods has not successfully extracted the entire sample. The most successful method identified involves an extended extraction period of 1 week using methanol before application to a plastic-backed TLC plate with a mobile phase consisting of acetone, n-butanol, and deionized water. The three manufacturers could be individually identified from each other under both natural and UV lighting and by the banding on the TLC plate allowing for better visualization.

Committee Members: Sean Fischer, Ph.D; Lyndsie Ferrara, Ph.D; Stephanie Wetzel, Ph.D.

Aizlynn Michel
4:30 PM

Analysis of Drug Content Distribution on Paper using both Soak and Spray Methods by Gas Chromatography-Mass Spectrometry (GC-MS)

In recent years, illicit substances have been increasingly smuggled into prison systems, which pose risks to any individual coming into contact with the mail. Despite the growing issue, little research has been conducted. This study aims to investigate the distribution of drugs on paper while observing both soak and spray methods. For this research, a 3.33 mg/mL solution was created by dissolving the drug in acetone. Each paper was either soaked or sprayed with the solution. After extraction, Gas Chromatography-Mass Spectrometry was used to analyze samples to observe the distribution of the surrogate drug on paper. Results show that drug concentration tends to increase along the edges of the paper and that there was a statistically significant difference between both soak and spray methods. By understanding how drugs are distributed on paper, further research can be conducted to help identify when a piece of mail has been tampered with.

Committee Members: Hannah Spitzer, M.S.; Ashley Ebert, Ph.D.; Stephanie Wetzel, Ph.D.

Sylvia Hamilton
5:00 PM

A Comparison of DNA Yield from Cotton and Nylon Swabs in Simulated Sexual Assault Samples

Sexual Assault Kit (SAK) collection is the process of collecting biological evidence from victims for use in the prosecution of a sexual assault. Since their inception in the 1970s, cotton swabs have been the predominant collection device utilized despite their tendency to embed DNA within the fiber matrix. In this study, two swabs were evaluated for their ability to release DNA: the traditional cotton swab, and the Copan® 4N6FLOQSwabs which have nylon fibers that purportedly rapidly release DNA. A differential extraction was performed on simulated samples of donated vaginal swabs treated with diluted semen using the Promega Differex™ and DNA IQ™ Systems with quantification performed using Quantifiler™ Trio kit. The findings demonstrated a statistically significant increase in DNA concentration retrieved from nylon swabs which has direct implications for forensic nursing, increasing robust prosecutions and improving outcomes for survivors of sexual assault.

Committee Members: Elizabeth Wisbon M.S.; Lindsey Campany M.S.; Pamela Marshall Ph.D.

END OF DAY ONE



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DAY TWO - FRIDAY, APRIL 5TH, 2024

Wolfe Lecture Hall Bayer

9:00 AM - 4:00 PM

9:00 AM- Can the Use of Sharpies® in Forensic Analysis be a Source of DNA Transfer and Contamination when Examining Different Scenarios?

Haley Murphy

9:30 AM- Examining the Relevance and Admissibility of Neuroimaging Evidence in Psychopathy and Insanity Defense Cases

Kaitlyn Svencer

10:00 AM- Assessing fentanyl concentrations in forensically relevant blow fly (Diptera: Calliphoridae) larvae to improve minimum postmortem interval estimations

Shelby Hale

10:30 AM

BREAK

10:45 AM- The Makings of a High-Profile Case: How Media Bias Influences Forensic Investigations in Missing Person Cases

Jennifer Fertel

11:15 AM- Detection of Low Concentration Ignitable Liquid Residues from Fire Debris Using Gas Chromatography-Mass Spectrometry and an Ignitable Liquid Detection Canine

Abigail Burke

Forensic Science & Law



DAY TWO - FRIDAY, APRIL 5TH, 2024

Wolfe Lecture Hall Bayer

9:00 AM - 4:00 PM

Continued

11:45 AM- Analysis of Sampling Techniques for the Detection of Organic Gunshot Residue (OGSR)

Matthew Lasker

12:15 PM

Lunch

1:15 PM- The Use of Leaf Spray Ionization Mass Spectrometry for the Detection Mitragynine in Kratom (*Mitragyna speciosa*)

Macenzie Powell

1:45 PM- Methods of Application for Internal Standards in Solid-Phase Extraction, in Preparation for Drug Quantitation on LC-QQQ-MS

Amy Cook

2:15 PM- Determination of Naloxone Levels When Administered in Drug Overdose Cases By LC-QqQ-MS

Chloe Bermejo

2:45 PM

BREAK



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DAY TWO - FRIDAY, APRIL 5TH, 2024

Wolfe Lecture Hall Bayer

9:00 AM - 4:00 PM

Continued

3:00 PM- The Significance of 3D Printed Firearms with Regards to Lethal Capacities and Traceable Elements

Caitlin Baker

3:30 PM- The Impact of Age on Strength and Fracture Patterns of the Human Hyoid Bone

Olivia DePergola

4:00 PM- The Effects of Thermal Stress on the Structure and Downstream DNA Analysis of Human Teeth

Michael Allie Brivchik

END OF DAY TWO

Forensic Science & Law



DAY TWO - FRIDAY, APRIL 5TH, 2024

Wolfe Lecture Hall Bayer

Abstracts:

Haley Murphy
9:00 AM

Can the Use of Sharpies® in Forensic Analysis be a Source of DNA Transfer and Contamination When Examining Different Scenarios?

Body fluids on fabric items are a commonly encountered type of evidence at crime scenes. During evidence processing, the fluid is outlined using a Sharpie® marker to assist DNA analysts to sample the correct area. The tip of the Sharpie®, which has direct contact with the fabric, is not decontaminated between uses. Additionally, the felt fibers of a Sharpie® tip are similar to the natural fibers of a cotton swab, which are utilized in crime labs to collect sources of DNA. The similarities between swab and Sharpie® fibers as well as repeated direct contact with body fluid-stained evidence increases the potential for DNA transfer. The ability of a Sharpie® to collect DNA was compared using an accidental sampling scenario and mock casework scenario. Furthermore, the amount of DNA transferred was analyzed based on fluid type, fabric type, and number of uses.

Committee Members: Lyndsie Ferrara, Ph.D.; Julie Sikorsky, M.S.; Pamela Marshall, Ph.D.

Kaitlyn Svencer
9:30 AM

Examining the Relevance and Admissibility of Neuroimaging Evidence in Psychopathy and Insanity Defense Cases

Neuroimaging, the visual aspect of neuroscience, refers to various forms of technology that are used to image the brain structurally and functionally. With increased utilization in court, this evidence type has been examined in terms of relevance and admissibility of brain scans for physical brain trauma. This research expanded on that work by assessing how brain scans are introduced and applied in various insanity defense and psychopathy cases. The study was conducted with two example cases of psychopathy and insanity defenses to examine the application and admissibility of the evidence. In the insanity defense cases, mental health assessment evidence and neuroimaging evidence were compared. In the psychopathy cases, the role of neuroimaging was analyzed to understand the application of this evidence type. Overall, the research investigated how neuroimaging evidence is used in court.

Committee Members: Jane Moriarty, M.A., J.D.; David DeMatteo, J.D., Ph.D.; Lyndsie Ferrara, Ph.D.

Shelby Hale
10:00 AM

Assessing fentanyl concentrations in forensically relevant blow fly (Diptera: Calliphoridae) larvae to improve minimum postmortem interval estimations

Forensic entomotoxicology is a subfield of forensic investigation involving analysis of illicit substances in entomological specimens. The development of this field has identified affected larval development resulting from drug compounds. Illicit drugs can alter carrion insect growth, which could decrease minimum postmortem interval (mPMI) estimation accuracy with entomological evidence. Few studies reflect the effects of fentanyl on insect growth despite its increasing misuse. Therefore, this study aimed to identify how fentanyl concentrations in human tissues affected blow fly (Diptera: Calliphoridae) larvae development. Fentanyl was distributed within cadaveric tissue and offered to larvae. In vivo measurements were taken, and larvae were euthanized after reaching the third instar stage of development. Following homogenization, larval samples were subjected to solid-phase extraction. The eluent was analyzed as an alternative toxicological matrix using liquid chromatography triple quadrupole mass spectrometry. By assessing the effects of fentanyl on carrion insect development, mPMI estimation accuracy can be improved.

Committee Members: Lyndsie Ferrara, Ph.D.; Jason Byrd, Ph.D., D-ABFE; Stephanie Wetzel, Ph.D.

Jennifer Fertel
10:45 AM

The Makings of a High-Profile Case: How Media Bias Influences Forensic Investigations in Missing Person Cases

Media bias often prioritizes white women over underrepresented individuals based on race, sexuality, ethnicity, or gender, thus neglecting those who don't fit societal ideals. This is commonly referred to as "Missing White Woman Syndrome." The implications of this bias in forensic investigations remain unexplored. To examine how media impacts forensic investigations, similar missing person investigations were compared. Additionally, a series of interviews were conducted with forensic investigators and media representatives. Both positive and negative impacts were observed but were found to be case-dependent. However, influences such as community involvement, finances and societal standing were observed in all cases. Understanding relationship dynamics between society, media, and missing persons is critical. Leveraging these relationships can increase advocacy and generate discussions on the missing person crisis, providing justice for all, regardless of media attention.

Committee Members: Charlene Shunick, M.S.; Lyndsie Ferrara, Ph.D.; Pamela Marshall, Ph.D.

Abigail Burke
11:15 AM

Detection of Low Concentration Ignitable Liquid Residues from Fire Debris Using Gas Chromatography-Mass Spectrometry and an Ignitable Liquid Detection Canine

Detection of ignitable liquid residues (ILRs) at a fire scene can indicate criminal activity and aid investigators in the classification of a fire. Ignitable liquid detection canines (ILDCs) are commonly used to assist in detecting potential remains of ILRs and direct investigators to notable locations for sample collection. There have been instances where gas chromatography-mass spectrometry (GC-MS) has been unable to confirm the presence of ILRs after an ILDC has alerted. In this study, twenty-seven samples of wood and carpet containing different volumes of gasoline were burned for varying periods of time. Subsequent ILDC and GC-MS analyses were performed and compared. Overall, the limits of detection for gasoline between these two methods were unable to be determined; however, the majority of test samples showed consistencies between ILDC alerts and GC-MS results. This research can spearhead further studies and may aid fire investigations by enhancing the analysis of fire debris.

Committee Members: Donald Brucker, CFEI; Nancy Love, B.S.; Matthew Regentin, M.S., IAAI-CFI; Stephanie Wetzel, Ph.D.

Matthew Lasker
11:45

Analysis of Sampling Techniques for the Detection of Organic Gunshot Residue (OGSR)

Organic gunshot residue (OGSR) is a collection of organic molecules that result from the firing of guns. A transition away from heavy metals in ammunition, which was traditionally analyzed, brings OGSR to the forefront of forensic importance. Various collection methods of OGSR were tested and compared to the current standard of gunshot residue collection, carbon adhesive coated scanning electron microscope (SEM) stubs. Volunteers fired five shots then their hands were swabbed with one of the various swab types. The collected OGSR were then analyzed and quantified by Liquid Chromatography Tandem Triple Quadrupole Mass Spectrometry (LC-QqQ-MS). Seven replicates of each method were collected, and statistics were performed using analysis of variance (ANOVA). The study hopes to determine the most effective method of collection of OGSR for analysis by LC-QqQ-MS. This advances the knowledge of the collection and detection of OGSR and allows for a future path of determination.

Committee Members: Kyle Brown, M.S., Jackson Dimalanta, M.S., Stephanie Wetzel, Ph.D.

Macenzie Powell
1:15 PM

The Use of Leaf Spray Ionization Mass Spectrometry for the Detection Mitragynine in Kratom (*Mitragyna speciosa*)

Mitragyna speciosa, known as kratom, is a Southeast Asia tree that produces the alkaloid mitragynine and is traditionally used to treat pain and fatigue. Recently, it became available in the United States and has been taken for various purposes, including to avoid opioid withdrawal. Growing abuse of kratom led the DEA to designate it as a drug of concern. The lack of information about a detection method for kratom led to the hypothesis of this research. Leaf spray ionization mass spectrometry (LSI-MS) can detect mitragynine directly from the leaf, indicating the presence of kratom. Mitragynine was detected in all three strains tested: maeng da, white maeng da, and red maeng da. Full scans contained a parent ion peak at 399m/z. Fragment ion peaks in the CID scans were 174m/z, 226m/z, 238m/z, and 367m/z. These results proved the hypothesis allowing this research to provide a method of detection for kratom.

Committee Members: Theodore Corcovilos, Ph.D.; Stephanie Wetzel, Ph.D.; Hannah Zimmerman-Federle, M.S.; Michael Van Stipdonk, Ph.D.

Amy Cook
1:45 PM

Methods of Application for Internal Standards in Solid-Phase Extraction, in Preparation for Drug Quantitation on LC-QQQ-MS

Toxicological analysis requires high precision and accuracy during sample preparation, which involves the extraction of analytes of interest from an often complex biological matrix. One possible technique to increase efficiency is pre-loading deuterated internal standards to later integrate into Solid-Phase Extraction (SPE), cutting out time-consuming steps and possible human error in sample preparation. In this study, SPE was performed on drug-spiked synthetic urine samples using pre-loaded frit materials and SPE cartridges, then Liquid Chromatography-Triple Quadrupole-Mass Spectrometry (LC-QQQ-MS) was used to analyze the extracts and determine percent recovery for each drug in all samples and controls. In addition, a time study was conducted in which the pre-loaded materials were stored to determine if recovery decreased over time. These experiments provide useful evidence about the reliability of pre-loaded internal standards, as well as the potential of creating pre-loaded frits and cartridges to eventually market to laboratories.

Committee Members: Colette Salerno, M.S.; Pamela Marshall, Ph.D.; Stephanie Wetzel, Ph.D.

Chloe Bermejo
2:15 PM

Determination of Naloxone Levels When Administered in Drug Overdose Cases By LC-QqQ-MS

The opioid epidemic in the United States stems from the growing illicit use of opioids, notably fentanyl and oxycodone, outside of their prescribed purpose of chronic pain management. Naloxone hydrochloride, more commonly known as naloxone or Narcan, is the most effective counteragent against an ongoing overdose which can be administered intravenously, intranasally, or subcutaneously. In post-mortem toxicology tests, naloxone is either not tested for or does not appear in tests. In this study, the opioids that were studied were fentanyl and oxycodone as well as heroin's major metabolites, morphine and 6-monoacetylmorphine (6-MAM). The analytes were extracted from spiked whole human blood samples using solid phase extraction (SPE) and analyzed with the Agilent 6460 liquid chromatography-triple quadrupole-mass spectrometer (LC-QqQ-MS) to determine a method of separation and quantification of naloxone. Quantifying naloxone is vital for understanding its interaction with opioids and blood cells, as well as its effectiveness in overdose situations.

Committee Members: Haley Berkland, M.S.; Jennifer Hammers, Ph.D.; Colette Miranda, M.S.; Stephanie Wetzel, Ph.D.

Caitlin Baker
3:00 PM

The Significance of 3D Printed Firearms with Regards to Lethal Capacities and Traceable Elements

Ghost guns are problematic in the forensic field due to their untraceable and undetectable elements. Metal detectors, gun-shot residue (GSR), serial numbers, and other commonly used firearm analysis methods have proven to be no match for these weapons in preliminary results. With the use of a 3D printer, three Liberator model guns were produced for this testing. This experiment utilized two polymers in the printing process: acrylonitrile butadiene styrene (ABS) and polylactic acid (PLA). By printing with alternating polymers, the structural integrity of each can be compared. Due to their explosive nature, a remote trigger-device was used to fire the assembled weapons. The guns were fired directly into a contained system to assess their lethality in humans. Gun remnants present at the conclusion of the firing process were collected for analysis. This research advances knowledge and understanding of 3D printed firearm analysis.

Committee Members: Zara Ellen Wenzinger, M.S.; Stephanie Wetzel, Ph.D.; John Viator, Ph.D.; Allison Laneve, M.S.; Brian Kohlhepp; Pamela Marshall, Ph.D.

Olivia DePergola
3:30 PM

The Impact of Age on Strength and Fracture Patterns of the Human Hyoid Bone

Fractures of the hyoid bone are significant indicators of trauma to the neck, causing them to garner great importance and relevance in the forensic science community. In this study, digital imaging files (.stl) of hyoid bones were collected from living patient CT scans. Four female bones were collected for each age group of 18-30, 30-45, and 45-80 years old. A Bambu Lab X1 3D printer was used to create four copies of each hyoid bone, and several morphological measurements were made before encasing the forty-eight bone models in gelatin and chamois. A Torbal Odyssey force gauge was utilized to determine the amount of force necessary to produce fracture and the location of fracture in a simulation of manual strangulation. The data suggests that there is no trend in force as age increases and that the location of fracture is nonrandom. This study aims to improve future manner of death conclusions.

Committee Members: Suvendra Vijayan, B.D.S., M.P.H., M.S.; John Viator, Ph.D.; Jennifer Hammers, D.O.; Pamela Marshall, Ph.D.

Michael Allie Brivchik

4:00 PM

**The Effects of Thermal Stress on the Structure
and Downstream DNA Analysis of Human Teeth**

Human identification cases stemming from natural disasters, terrorist attacks, fires, and car accidents often use recovered teeth as a viable source of DNA. However, sufficient DNA from a tooth may be a challenge to obtain if they are exposed to extreme heat, especially for an extended time period. This study demonstrates that the DNA quality is compromised under thermal stress. For this project, forty-four human wisdom teeth were collected following extraction an oral surgeon between 2019 - 2020. This study used two male and two female individual wisdom teeth at each extreme temperature, 500°C, 700°C, and 900°C. DNA was analyzed by quantification, amplification, and ran on a CE. Profiles were created and allele locus dropout, peak height ratio (PHR), and degradation values were determined. Overall, this study advances the knowledge on heat transfer and the ability to extract DNA from human teeth exposed to thermal stress.

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END OF DAY TWO



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Thank You Note from Dr. Pamela Marshall

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