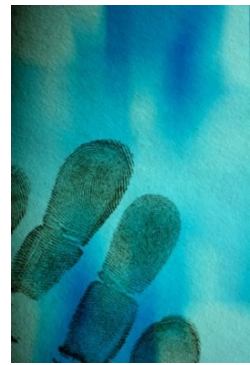
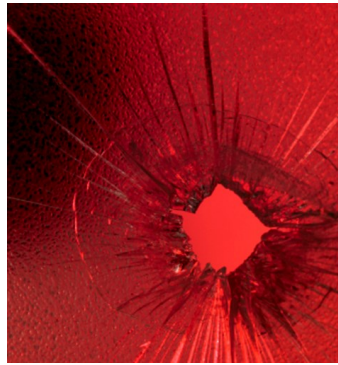




Forensic Science & Law Graduate Research Symposium



April 1-2, 2022
Hy-Flex*

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*Hy-Flex due to Covid-19 Pandemic



Graduate Research Symposium Day 1

Friday, April 1, 2022
8:30am—5:15pm

| Time | Title | Presenter |
|-------------|---|-------------------|
| 8:30am | Suicide Rates & Trends within Allegheny County from 2010—2019 | Odile Enslin |
| 9:00am | Distribution of Drugs on Paper via the Soak and Spray Methods | Hannah Spitzer |
| 9:30am | Down the Drain: Embalming Fluid Disposal | Tiffany Hoke |
| 10:00am | <i>Break</i> | |
| 10:15am | Difference in Levels of Tryptophan, Kynurenine and Vascular Endothelial Growth Factor in Different Manners of Death | Sara Magoun |
| 10:45am | Determination of Death by Suicide or Homicide Through Hyoid Bone Fracture Patterns | Roger Sherman |
| 11:15am | The Relevance of Current Forensic Firearms Examination Techniques When Applied to 3D Printed Firearms | Ellen Wenzinger |
| 11:45am | <i>Lunch</i> | |
| 1:00pm | Development of a Rapid Drug Detection Method for Insects using Paper Spray Ionization Mass Spectrometry (PSI-MS) | Alexandria Plyler |
| 1:30pm | Detection of Methanol in Cocktails by Paper Spray Ionization-Mass Spectrometry | Derek Heacox |
| 2:00pm | Extraction of CBD from Gelatin Edibles with Analysis by PSI-MS | Cheyenne Granger |
| 2:30pm | Direct Sampling and Identification of Illicit Substances Impregnated in Paper using Paper Spray Ionization Mass Spectrometry | Kyra Hardenburg |
| 3:00pm | <i>Break</i> | |
| 3:15pm | Analysis of Full-Spectrum CBD Oils to Determine THC Levels Using Liquid | Jordyn Essinger |
| 3:45pm | Validation of an LC/MS/MS Method | Nicole Haase |
| 4:15pm | Direct Isotope Dilution Mass Spectrometry Quantification of Dried Blood Spot Cards to Identify Drugs of Abuse | Caley Moore |
| 4:45pm | Examining What Successful Re-entry Looks Like: Looking Beyond Recidivism Rates to the Human Experience | Kari Danser |

8:30am Odile Enslin

Suicide Rates & Trends within Allegheny County from 2010—2019

Suicide studies and research are not a newly studied area and numerous research studies have established trends within the scope of suicide, examining differences across gender, age, and race, fewer studies have focused on community-level factors such as income. This research makes a unique contribution by pairing, suicide data from the Allegheny Medical Examiner's office during the period of 2010 through 2019 and poverty threshold data from the Census Bureau's American Community Surveys. This research examined whether impoverished communities have higher suicide rates than non-impoverished communities. Furthermore, this study asked: do impoverished communities have different rates and trends when examining cause of death in suicides? Results from this study aim to improve education and preventative measures, but also provides a macroscopic examination of suicide beyond examining individual cases to provide another layer of contextual information that can aid future prevention efforts.

Committee Members: Lyndsie Ferrara, Ph.D.; Anita Zuberi, Ph.D.; Mandy Tinkey, M.S.

9:00am Hannah Spitzer

Distribution of Drugs on Paper via the Soak and Spray Methods

Trafficking and use of illicit substances within correctional facilities has become a major concern. Individuals have used the "soak and spray method" in attempt to smuggle illicit substances through the mail into correctional facilities via cards, letters, and documents. This method entails spraying or soaking paper in a mixture of a household solvent and the desired drug making detection difficult. The purpose of this research is to observe distribution patterns of various drugs on paper using the soak and spray method. Samples are created using a mixture of acetone and the desired drug with a concentration of 3.33mg/mL. Samples are extracted using methanol, syringe filtered, and analyzed via the Agilent Gas Chromatography Mass Spectrometer. This project uses two surrogate drugs, caffeine and acetaminophen, and two matrices, cardstock and computer paper, to observe distribution methods of drugs on paper allowing for subsequent testing to assess variability of detection of these methods.

Committee Members: Stephanie Wetzel, Ph.D.; Mandy Tinkey, M.S.; Erica Maney, M.S.

9:30am Tiffany Hoke

Down the Drain: Embalming Fluid Disposal

Most embalming fluid used throughout the United States contains the chemical formaldehyde which is known to have adverse effects on the health of humans and the environment. It has recently come to the attention of disposal companies that the embalming fluid used in funeral homes is simply washed down the drain along with other bodily fluids, including blood. A literature review was conducted to determine the effects of formaldehyde on the environment and water. An investigation was conducted by emailing or phone interviewing two funeral homes per county about their background, education, and disposal methods, however, only one response per county was used in the results. The majority of funeral homes have stated in these responses that they allow the embalming fluid and other bodily fluids to go down the drain. This research aims to determine if these methods are safe and sanitary or if proper biohazard disposal is needed.

Committee Members: Stephanie Wetzel, Ph.D., Pamela Marshall, Ph.D.; Nicole Rodrigues Rial, J.D.

10:15am Sara Magoun

Difference in Levels of Tryptophan, Kynurenine and Vascular Endothelial Growth Factor in Different Manners of Death

Recently, researchers have been studying the idea that inflammation can cause depression or symptoms of depression. Molecules such as tryptophan, kynurenine and vascular endothelial growth factor are some of the molecules that are included in this new research. Tryptophan and Kynurenine are either neuroactive and helping contribute the symptoms of depression or their irregular amounts are a possible indication of depression. Vascular endothelial growth factor is considered a neurotrophin because it contributes to the preservation of neurons. A neurotropic model of depression suggests that increased stress decreases the amount of neurotrophins available and can lead to depression. Postmortem blood samples were analyzed using LC/MS/MS for levels of tryptophan and kynurenine to see if there was a difference depending on the manner of death. This technique could be used to help determine manner of death in cases where it is unclear and if there is a link between biomarkers and depression.

Committee Members: Stephanie Wetzel, Ph.D.; Jennifer L. Hammers, D.O.; Kasey Gizler, B.S.

10:45am Roger Sherman

Determination of Death by Suicide or Homicide Through Hyoid Bone Fracture Patterns

Distinguishing between a true suicidal hanging and a homicidal strangulation is difficult even for highly trained professionals. Little has been done on identifying minor indicators, such as differences in hyoid fracture patterns, as most investigators search for obvious signs like ligature marks or defensive wounds. To determine whether hyoid bone fractures can be used to distinguish between suicide and homicide, four hyoid bones were harvested, cleaned, and scanned using a CBCT imaging system for 3D printing. Six models of each bone were printed and embedded into collagen gel, then crushed at front and side profile angles using a Torbal® Odyssey test stand and force gauge. Slight variations in the force required to fracture the models were found, proving that a model-based approach is a valid testing method. This research could allow for better detection of staged suicides and provide more resources for investigators to determine the mode of death. Keywords: hyoid, manner of death, strangulation.

Committee Members: Pamela Marshall, Ph.D.; John Viator, Ph.D.; Jennifer L. Hammers, D.O.

11:15am Ellen Wenzinger

The Relevance of Current Forensic Firearms Examination Techniques When Applied to 3D Printed Firearms

This research investigated how the Trace Evidence and Firearms & Toolmark sections of forensic science can be applied to 3D printed firearms. A 3D printed model, the Liberator, was printed on a cheap commercial printer out of polylactic acid (PLA). Four main points were established. First, that the 3D printing process does not deposit lead, antimony, or barium that might be confused with gunshot residue (GSR) during SEM-EDS analysis. Second, that GSR particles could be identified via SEM-EDS analysis from the bullet, cartridge case, the barrel, and miscellaneous pieces of thermoplastic. Third, possible thermoplastic spindles were deposited on the cartridge case. And fourth, no rifling or individual characteristics were present on the bullet or cartridge case. In conclusion, this novel research aims to answer questions regarding the analysis of forensic evidence obtained from 3D printed firearms before any potential widespread use.

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

1:00pm Alexandria Plyler

Development of a Rapid Drug Detection Method for Insects using Paper Spray Ionization Mass Spectrometry (PSI-MS)

Forensic scientists can potentially utilize necrogenous insects as toxicological specimens to detect drugs in cadavers that lack useable tissue. Traditional toxicological analysis of insects via liquid chromatography mass spectrometry (LC-MS), however, often requires lengthy sample preparation, uses expensive reagents, and is destructive to specimens. Paper spray ionization mass spectrometry (PSI-MS), could provide a rapid, cost-effective, yet reliable alternative to the LC-MS analysis of insects. The goal of this project is to explore PSI-MS for the detection of drugs in insects that have fed on spiked substrate. Model *Tenebrio molitor* insects fed on oat substrate spiked with the drug surrogate phenethylamine (PEA) and were extracted using methanol, QuEChERS (Quick, Easy, Cheap, Effective, Rugged, Safe) extraction, and a novel “bug-spray” technique. Samples were then analyzed using PSI-MS with collision induced dissociation (CID), as well as liquid chromatography triple quadrupole mass spectrometry (LC-QQQ-MS) to evaluate the most rapid, yet effective methodology.

Committee Members: Michael Van Stipdonk, Ph.D.; Stephanie Wetzel, Ph.D.; Connor Graca, M.S.; Michael Jensen-Seaman, Ph.D.

1:30pm Derek Heacox

Detection of Methanol in Cocktails by Paper Spray Ionization-Mass Spectrometry

In May of 2020, because of SARS-CoV-2 virus, distilleries in Chiconautla, Mexico were labelled non-essential, resulting in an influx of counterfeit liquors by criminal organizations. As of April 2021, 326 people have been treated with methanol poisoning and 127 people in the Dominican Republic have died because of consuming methanol-laced alcoholic beverages. The purpose of the study is to determine if a counterfeit alcohol can be found in a cocktail-like solution using Paper Spray Ionization-Mass Spectrometry (PSI-MS). A piece of filter paper was infused with silver nitrate, a series of deuterated ethanol and methanol standards were created to determine if methanol could be found using the PSI-MS methods. A vodka soda sample was then made containing a lethal amount of methanol, Pinnacle Vodka, and Sprite. In the pure Pinnacle Vodka sample only trace amounts of methanol were found. This experiment focused on the qualitative analysis rather than quantitative.

Committee Members: Michael Van Stipdonk, Ph.D.; Stephanie Wetzel, Ph.D.; Luke Metzler, M.S.

2:00pm Cheyenne Granger

Extraction of CBD from Gelatin Edibles with Analysis by PSI-MS

Recently, the U.S. has observed a rise in cannabis product usage. With this rise, an influx of cannabis related evidence could be observed in laboratories resulting in significant disruption to evidence processing. The current analysis methods for CBD (cannabidiol) gelatin edibles, a popular cannabis product, could become inhibitory due to lengthy processing times. While current methods are effective, the use of PSI-MS (paper spray ionization mass spectrometry) was hypothesized to increase efficiency of CBD identification from these edibles. SIPSMS (silver impregnated PSI-MS) was developed for the rapid detection and attempted quantification of CBD from gelatin edibles. Through this technique, increased efficiency of identification was observed along with needed improvement for quantification. With SIPSMS, laboratories may decrease the cost and time needed for CBD gelatin edible analysis. Additionally, SIPSMS may provide a solution to offset backlogging created by increased cannabis usage. Future research with SIPSMS may further impact cannabis forensic analysis.

Committee Members: Michael Van Stipdonk, Ph.D.; Stephanie Wetzel, Ph.D.; Benjamin Bythell, Ph.D.

2:30pm Kyra Hardenburg

**Direct Sampling and Identification of Illicit Substances
Impregnated in Paper using Paper Spray Ionization
Mass Spectrometry**

In many prisons around the United States, illicit substances being brought into prisons through drug-soaked mail have been a major problem. As the number and potency of illicit drugs rise, the need for rapid, selective, and sensitive analytical techniques increases as well. Paper Spray Ionization (PSI) is a newly developed ambient source used to analyze solid or liquid compounds on the surface of a paper substrate. The goal of this study was to determine if Paper Spray Ionization Mass Spectrometry (PSIMS) would be an effective method in determining illicit substances in paper. The illicit substances analyzed were phenethylamine and methamphetamine. Substances were added to the paper directly before analysis and two days prior to analysis. This method can be held to the same standard as current methods and can be incorporated into the prescreening of inmate mail to help lessen the number of drugs being smuggled into these correctional facilities.

*Committee Members: Michael Van Stipdonk, Ph.D.; Stephanie Wetzel, Ph.D.;
Frederick W. Fochtman, Ph.D.*

3:15pm Jordyn Essinger

**Analysis of Full-Spectrum CBD Oils to
Determine THC Levels Using Liquid**

The purpose of this study is to analyze the different components present in a variety of cannabidiol oils, including an analysis of tetrahydrocannabinol (THC) levels. Δ 9-tetrahydrocannabinol (Δ 9-THC) is illegal in the United States if it is in excess of 0.3%.¹ However, Δ 8-tetrahydrocannabinol (Δ 8-THC) falls into a gray area in terms of legality under the 2018 Agricultural Improvement Act.² A liquid-liquid extraction method was developed to purify and separate the compounds within full-spectrum CBD oils obtained from four different companies. Full-spectrum extracts contain all cannabinoids naturally found in the marijuana plant, including THC.³ After extraction, the samples were tested using liquid chromatography-mass spectrometry (LC-MS) to quantify the expected three main components: CBD, Δ 8-THC, and Δ 9-THC. The main focus of the study was to determine if the THC content in each sample exceeded the maximum federal limit and if Δ 8-THC and Δ 9-THC could be differentiated using the developed method.

Committee Members: Stephanie Wetzel, Ph.D.; Lyndsie Ferrara, Ph.D.; Frederick W. Fochtman, Ph.D.

3:45pm Nicole Haase

**Validation of an LC/MS/MS Method
for 23 Fentanyl Analogs in Oral Fluid**

Currently, synthetic opioids including fentanyl analogs are the leading cause of overdose deaths in the United States. The increase in drug abuse causes the need for quick and efficient drug detection methods for fentanyl analogs in various biological matrices. In this study, a rapid LC/MS/MS method was developed and validated for analyzing expectorated oral fluid samples for 23 fentanyl analogs. Samples were prepared by phospholipid depletion and protein precipitation using whole blood or oral fluid and 1% acetic acid in acetonitrile. Separations were completed using an Agilent ZORBAX Eclipse XDB-C18 (2.1x100mm) with a Vanquish™ Ultra High-Pressure Liquid Chromatography (UHPLC) System. Gradient elution was performed with 0.1% formic acid in water and acetonitrile. Identification and quantitation were conducted with a TSQ Endura™ Triple Quadrupole-Mass Spectrometer (QQQ-MS) operating in selective reaction monitoring (SRM) mode. Validation results show that analytes are detected in oral fluid at significantly lower LOQs than in whole blood.

*Committee Members: Stephanie Wetzel, Ph.D.; Ashley Trouten, B.S.; Frederick W. Fochtman, Ph.D.;
Haley Berkland, M.S.*

4:15pm Caley Moore

Direct Isotope Dilution Mass Spectrometry Quantification of Dried Blood Spot Cards to Identify Drugs of Abuse

The current opioid epidemic warrants an immediate drug detection technique which can identify illicit and prescribed substances, consumed above the therapeutic level. The employment of dried blood spot (DBS) cards provides a minimally invasive, stable, and portable medium to collect blood samples via finger prick technology. In this study, quantitative DBS cards were assessed for twenty drugs of abuse in their natural and isotopically enriched states via Isotope Dilution Mass Spectrometry (IDMS). IDMS ensures accurate quantification in various matrices while eliminating inherent errors produced by traditional calibration curves. Drug viability was demonstrated from a blood matrix via Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS) partnered with the GERSTEL DBS Autosampler. This methodology demonstrates optimized parameters, extensive MRM transitions, automated desorption, and detection limits as low as parts per billion (ppb). Developed methods will facilitate future applications in immediate drug detection for law enforcement and emergency personnel to improve public health and safety.

Committee Members: Skip Kingston, Ph.D.; Stephanie Wetzel, Ph.D.; Logan Miller, M.S.; Frederick W. Fochtman, Ph.D.

4:45pm Kari Danser

Examining What Successful Re-entry Looks Like: Looking Beyond Recidivism Rates to the Human Experience

Each year thousands of individuals are released from prison and re-enter society. In research, successful re-entry is commonly defined as the absence of recidivism without examining the experiences of those who have successfully re-integrated back into society. Recidivism measures the individuals who commit a criminal act or have a parole violation following release from prison. Rather than focus on recidivism, this study examines successful re-entry as defined by those with lived experience. To better understand the re-entry process, semi-structured qualitative interviews were conducted with male and female returning citizens. Data analysis revealed the barriers encountered by these individuals align with historical re-entry research that highlights primary challenges with housing and employment. Although re-entry experiences were determined to be unique to each individual, common themes of self-care and support systems were identified as key contributors to successful re-entry. This work highlights the importance of the human experience when examining successful re-entry.

Committee Members: Lyndsie Ferrara, Ph.D.; Joshua Ellsworth, Ph.D.; Thomas Farrell, J.D.





Graduate Research Symposium Day 2

Saturday, April 2, 2022
8:30am—3:30pm

| Time | Title | Presenter |
|-------------|---|-------------------|
| 8:30am | Estimating Decomposition Time Via Bacteria from Rat Models | Kayce Boggess |
| 9:00am | The Role of Juror Bias Relating to Sexual Assault Cases | Noelle Sadaka |
| 9:30am | Impact of COVID-19 on Sexual Assaults in the City of Pittsburgh—A Case Study | Brooke Baker |
| 10:00am | DNA Integrity and Fungal Contamination as a Function of Time in Freshwater Drowning Deaths | Maeve Godshalk |
| 10:30am | <i>Break</i> | |
| 10:45am | Semen Identification through the Detection of Fructose Levels | Emily Chadwick |
| 11:15am | Production of Recombinant Semenogelin Protein Fragments for the Improved Antibody-based Detection of Body Fluids | Thomas Washington |
| 11:45am | Estimating Sex Based on Small Bone Metrics Combinations | Annie Panageas |
| 12:15pm | <i>Lunch</i> | |
| 1:30pm | Using Online Learning and Gamification to Enhance Ethics Education in Forensic Science | Sarah McKendrick |
| 2:00pm | Impact of Different Soil Matrices on Human DNA Leaching from Tissue | Kaylee White |
| 2:30pm | An Enhanced DNA Extraction Method for Charred Human Remains Using Pressure Cycling Technology (PCT) | Kira Hurley |
| 3:00pm | DNA Extraction and Chemical Analysis of Metacarpals | Sydney Reed |

8:30am Kayce Boggess

Estimating Decomposition Time Via Bacteria from Rat Models

Microbiomes are unique individualized communities of microbes that live on and in human bodies. The presence and quantity of the microbiome of the body change as the body decomposes. This study aimed to quantify these changes to estimate a decomposition time model. Current research looks at open-air environment decomposition models based on the appearance of the decomposing body and insects. However, decomposition looks different in closed environments when only the microbiome and other bacterial species are present to perform decomposition. Using DNA extraction, quantification, and a massive literature review, this study aims to find a common pattern of decomposition. This study concludes if there is a pattern and/or order of bacterium in microbiomes that relates to decomposition time and if there is a major difference in this information between closed and open-air environments.

Committee Members: Lyndsie Ferrara, Ph.D.; Lisa Ludvico, Ph.D.; Evan Penrod, M.S.; Jan Janecka, Ph.D.

9:00am Noelle Sadaka

The Role of Juror Bias Relating to Sexual Assault Cases

Upon evaluation of sexual assault cases, there is bias present in jurors. A loss of justice for victims often results. The purpose of this study was to examine if juror bias related to sexual assault cases can be identified and what biases are present. A Qualtrics survey was created and distributed through social media. Included were mock scenarios depicting sexual assault cases with changing contextual elements. Three scenarios were randomly selected for each participant and questions following served to assess the participants' interpretation of the case. The factors analyzed were plaintiff's age, respectability, relationship to the perpetrator, sexual orientation, and the environment of the incident. Statistical analysis was performed to determine if the variation of responses between scenarios was significant. The results of this study supported the hypothesis that biases would include age, gender, environmental, and situational bias. Based on results of this study, mitigation and reform can be implemented.

Committee Members: Lyndsie Ferrara, Ph.D.; Pamela Marshall, Ph.D.; Brian Kohlhepp, M.A.

9:30am Brooke Baker

Impact of COVID-19 on Sexual Assaults in the City of Pittsburgh—A Case Study

The rate of sexual assaults has been shown to increase during states of emergency. When COVID-19 quarantine began, many organizations reported an increased demand for sexual assault (SA) victim services, but many hospitals and police departments reported a decrease in the number of SA exams performed and sexual assault kits (SAKs) collected. While 911 calls reporting domestic violence increased during lockdown, official police reports and arrests declined. This research examined how the COVID-19 pandemic has impacted SAs and SAK collection regionally, nationally, and globally. A literature review was performed, SAK data was collected in Allegheny County, and interviews were conducted with individuals working in Pittsburgh. The results indicated that the COVID-19 pandemic has impacted the SA crisis, but more research needs to be done on a larger scale. This research demonstrated how a worldwide crisis like the COVID-19 pandemic can greatly impact another major issue like the SA crisis.

Committee Members: Pamela Marshall, Ph.D.; Lisa Ludvico, Ph.D.; Elizabeth Wisbon, M.S.; Brian Kohlhepp, M.A.

10:00am Maeve Godshalk DNA Integrity and Fungal Contamination as a Function of Time in Freshwater Drowning Deaths

Drowning and drowning deaths are categorized as a public health issue. Bodies recovered in freshwater environments often present fungal contamination of the bodily tissue, and subsequent human DNA. *Candida albicans* is an opportunistic, pathogenic fungus found in the human body. It lives within the body without any harm to the host, unless the host becomes immunocompromised. This is also true in freshwater environments. By inoculating human tissue samples with *C. albicans* in river water, optical density readings at different time points can determine the rate at which the fungus grows in relationship to the tissue. DNA processing of the human tissue can determine the level of tissue degradation, and subsequent positive or negative correlation with the growth of the fungus. This work aims to give forensic laboratories a better understanding of tissue contamination as it relates to fungus, and improve decision-making in regard to processing such samples.

Committee Members: Jana Patton-Vogt, Ph.D.; Lisa Ludvico, Ph.D.; Benjamin Cooley, M.S.

10:45am Emily Chadwick Semen Identification through the Detection of Fructose Levels

Body fluids such as semen, blood, urine, and vaginal fluid are commonly found at crime scenes. To differentiate and identify body fluids, presumptive and confirmatory tests are used. Currently, the acid phosphatase test is used to detect semen; however, vaginal fluid can also contain acid phosphatase leading to false positive or negative results. Although semen contains acid phosphatase, it also contains a high concentration of fructose. The purpose of this study was to determine if semen can be detected through its concentration of fructose. The concentration of fructose in semen, blood, urine, and vaginal fluid samples were determined using a fluorometric assay. The concentration of fructose in a liquid sample was quantified using the assay. Results showed fructose has a high concentration in semen. It was determined fructose concentrations could be quantified using dried samples on cotton swabs. If this detection method is optimized, it will benefit sexual assault casework.

Committee Members: Pamela Marshall, Ph.D.; Michael Jensen-Seaman, Ph.D.; Elizabeth Wisbon, M.S.; Benjamin Cooley, M.S.

11:15am Thomas Washington Production of Recombinant Semenogelin Protein Fragments for the Improved Antibody-based Detection of Body Fluids

Body fluid identification is an important component of forensic science. Current semen identification tests have flaws, including false positives and false negatives. Therefore, we seek to develop an improved semen identification test. To do this, we produced and purified recombinant fragments of an abundant seminal plasma protein (semenogelin-I). Using databases of human genetic variation, we found one fragment of semenogelin-I (later named the THW fragment) containing no common nonsynonymous SNPs. A different fragment of semenogelin-I (the SPMI fragment) targeted by a commercially available test, along with an allelic variant of the SPMI fragment containing a common nonsynonymous SNP, were also produced and purified. We evaluated the ability to detect these fragments with a commercially available semenogelin-targeted semen identification kit. Overall, the study seeks to improve serological testing aimed at semen identification by providing a test with fewer false positives and negatives, through targeting semenogelin and consideration of common allelic variants.

Committee Members: Michael Jensen-Seaman, Ph.D.; Pamela Marshall, Ph.D.; Benjamin Cooley, M.S.

11:45am Annie Panageas

Estimating Sex Based on Small Bone Metrics Combinations

The pelvis and the skull give near 100% accuracy in determining sex of human skeletal remains, these bones are rarely present in forensic cases. Typically, only small bones are present that are not very useful in identification due to the lack of knowledge on the differences between males and females. In an effort to explore the utilities of these bones it is hypothesized that there exists a significant size and shape difference between male and female small bones. By looking at a series of small bone metrics in a 30-cadaver geriatric population and pairing them together, an accuracy can be determined that is close to the high accuracy of the pelvis and skull. These bones were taken from the extremities, the neck, and the knee. Results of the present study confirm the hypothesis in terms of the size of the small bones and partially confirm in terms of the shape.

Committee Members: Anne Burrows, Ph.D.; Pamela Marshall, Ph.D.; Bobbie Leeper, Ph.D.; Michael Jensen-Seaman, Ph.D.; Lisa Ludvico, Ph.D.

1:30pm Sarah McKendrick

Using Online Learning and Gamification to Enhance Ethics Education in Forensic Science

Despite the importance of ethical practices in forensic science, employers have reported a deficiency of ethics education in the workplace. This research aimed to enhance ethics education in forensic science by implementing a flipped-classroom model using online learning and gamification. It was hypothesized that a flipped-classroom model would be an effective pedagogical model for ethics education. To gather information about what to include in the content, interviews and surveys were conducted with ethics educators and forensic science personnel. The interviews and surveys with forensic science personnel exposed contemporary ethical dilemmas encountered in the workplace. Before class, students completed online modules pertaining to ethical concepts. A comparison of pretest and post-test scores was used to determine a gain in knowledge. During class time, students participated in gamification activities to apply what they learned. Results indicate a statistically significant gain in knowledge through the completion of the online modules and gamification activities.

Committee Members: Lyndsie Ferrara, Ph.D.; Pamela Marshall, Ph.D.; Sara Bitner, M.S.; James Schreiber, Ph.D.

2:00pm Kaylee White

Impact of Different Soil Matrices on Human DNA Leaching from Tissue

When bodies undergo the process of decomposition, DNA leaches into the surrounding environment, usually soil. Soil is a complex mixture, unique in its composition. The purpose of this study was to research and understand the specific interactions between DNA and different soil types. Small pieces of tissue were allowed to decompose in the following: organic loam soil, sand, sandy-loam mixture soil, Houston area Texas Red Clay, and agricultural soil. It has been hypothesized there will be a smaller quantity of DNA extracted from the sand and a higher quantity extracted from the clay due to the specific structure and composition of the respective particles. These findings aimed to provide specific information on the different absorption and retention rates of DNA in different soils. The knowledge gained from this research can be utilized in the recovery of human remains, providing specified information on how soils impact the rate of DNA leaching.

Committee Members: Lisa Ludvico, Ph.D.; Pamela Marshall, Ph.D.; Robert Gallagher, J.D.; Lyndsie Ferrara, Ph.D.

2:30pm Kira Hurley

An Enhanced DNA Extraction Method for Charred Human Remains Using Pressure Cycling Technology (PCT)

Charred human remains can undergo forensic DNA testing for a variety of scenarios, including arson and mass disasters. This can present challenges as exposure to heat damages DNA, reducing quality and quantity of genetic data available for identifications. Teeth have minerals in their microstructure that are PCR inhibitors that create downstream issues in DNA analysis. Pressure Cycling Technology (PCT) was utilized in this study to increase quantity and quality of DNA. PCT has been shown to reduce the effect of PCR inhibitors, yielding higher quantities of DNA and cleaner genetic profiles. For this, human teeth were burnt at various, pre-defined temperatures in a furnace. The burnt teeth underwent a modified organic DNA extraction, half underwent an additional PCT step after lysis. The results showed the samples that underwent the additional PCT step on average yielded more DNA at higher temperatures and a cleaner profile compared to the normally extracted samples.

Committee Members: Pamela Marshall, Ph.D.; Lisa Ludvico, Ph.D.; Angie Ambers, Ph.D.

3:00om Sydney Reed

DNA Extraction and Chemical Analysis of Metacarpals

This research aimed to develop a technique to extract an adequate amount of the co-mingled, degraded DNA from the sample by adding Pressure Cycling Technology as a purification step to half the samples to determine if it could increase DNA yield. Metacarpals were overlapped and burned to mimic the process of comingling. The bones were then ground into a powder then extraction was performed using Organic Extraction. The control samples did not yield enough DNA based on quantification results and it was determined that the samples had been treated with a preserving agent. An HPLC tandem Triple Quadrupole Mass Spectrometer was used to determine the preserving agent with standards of a formalin, embalming fluid and formaldehyde as they are common preservatives. Determining the preserving agent used on the metacarpal standards will aid the understanding to why the Organic DNA extraction method did not yield any DNA in the control samples.

Committee Members: Pamela Marshall, Ph.D.; Lisa Ludvico, Ph.D.; Stephanie Wetzel, Ph.D.; Angie Ambers, Ph.D.

