2025 GRADUATE RESEARCH SYMPOSIUM

Forensic Science & Law

MARCH 28, 2025

DUQUESNE UNIVERSITY

If you wish to join in person:

Join us at:
Duquesne University in Pittsburgh, PA
The symposium will be held in:
Rockwell Lecture Hall 2

If you wish to join via Zoom:

Click this link to join:
https://duq.zoom.us/j/91493297893
pwd=qM6kahXpYHLxaJqjwbc9
Mdd9u4RuQU.1
Meeting ID: 914 9329 7893
Passcode: forensic

Friday, March 28th, 2025

Rockwell Hall Lecture Hall 2

10:30 AM - 6:30 PM

10:30 AM - An Analysis of Human DNA Extraction from Plants in a Mock Burial	**Rebecca Sines**
11:00 AM - Examining the Use of Massively Parallel Sequencing (MPS) in Forensic Science	**Kirsten Littrell**
11:30 AM - Examining the Presence of Foreign DNA on Neck Swabs	**Alexa Gonzalez-Morales**
12:00 PM	**LUNCH BREAK**
1:00 PM - Healthcare Disparities: A Comparative Analysis of Forensic Nursing and Sexual Assault Prevalence	**Chloe Rapp**
1:30 PM - Examining Solutions to the Sexual Assault Kit Backlog	**Gabrielle Gibbons**

DUQUESNE UNIVERSITY

Friday March 28th, 2025

Rockwell Hall Lecture Hall 2

10:30 AM - 6:30 PM

2:00 PM - Implicit Bias and the Link to Juror Selection in Capital Punishment Cases	**Zarena Nieves-Figueroa**
2:30 PM - Using Virtual Reality as a Format of Crime Scene Presentation by an Expert Witness during a Mock Jury Trial in the United States	**Jocelyn Rodriguez**
3:00 PM	**BREAK**
3:15 PM - Identification and Quantification of Illicit Drugs in Blood Using Stir Bar Sorptive Extraction and LC-QQQ-MS	**Abigail Noll**
3:45 PM - The Persistence of Human eDNA in Air	**Kayla Houghton**
4:15 PM - DNA Extraction from Teeth Optimization and Subsequent DNA Mixture Analysis of Co-mingled, Burnt Remains (CBR)	**Sydney Bivens**

Forensic Science & Law

Friday March 28th, 2025

Rockwell Hall Lecture Hall 2

10:30 AM - 6:30 PM

4:45 PM - Quantitative Determination of Heroin and Fentanyl in Dried Blood Spots on Various Surfaces	**Rachel Westley**
5:15 PM	**BREAK**
5:30 PM - The Efficiency and Efficacy of Male DNA Extraction from Sexual Assault Kits with Variations in Washes	**Ian Smilnak**
6:00 PM - Ancient DNA Analysis Using Massively Parallel Sequencing (MPS) on Skeletal Remains from Rhodes, Greece	**Erin Pyle**

DUQUESNE UNIVERSITY

Friday March 28th, 2025

Rockwell Hall Lecture Hall 2

Abstracts:

Rebecca Sines
10:30 AM

An Analysis of Human DNA Extraction from Plants in a Mock Burial

Human DNA extractions have been performed in previous studies from soil, but the microbial activities in the soil caused DNA degradation. The purpose of this study was to determine whether human DNA can be extracted and quantified from plants grown in blood-infused and human flesh-infused soil. This project focused on DNA extraction from plants to determine if recovery was possible in order to develop a human profile. Phase one focused on lima beans planted in soil with 100 µL or 1000 µL of blood. In phase two, lima beans were planted into 1000 µL blood-infused soil or tissue-infused soil. After one month, samples underwent analysis to determine whether a profile can be obtained. No STR profiles were developed from the extracted samples. Further research is needed to obtain a higher quantity and quality of human DNA from plants in mock burials.

Committee Members: Lyndsie Ferrara, Ph.D.; Matthew Regentin, M.S.; Sheree Hughes, Ph.D.; and *Pamela Marshall, Ph.D.*

Kirsten Littrell
11:00 AM

Examining the Use of Massively Parallel Sequencing (MPS) in Forensic Science

Massively parallel sequencing (MPS), also known as next generation sequencing (NGS), is a novel, high-throughput sequencing method that has revolutionized the DNA analysis process. While widely used in medical microbiology, disease diagnostics, and biotechnology, MPS has recently gained traction in forensic science, as evidenced by an increasing volume of research exploring its forensic applications. As forensic casework becomes increasingly complex, there is a growing demand for technologies capable of handling challenging samples. Although MPS is a newer technology, it shows great promise in addressing common DNA casework challenges, such as degraded or limited DNA samples and complex mixtures. Its ability to generate extensive data from minimal starting material and provide more information from a greater variety of genetic markers makes it especially valuable for forensic biology applications. This research aims to examine MPS's growing role in forensic biology and its impact on DNA analysis thus far.

Committee Members: Kirsten Littrell, B.S.; Nicole Novroski, Ph.D.; Jennifer Bracamontes, M.S.; Pamela Marshall, Ph.D.; and *Lyndsie Ferrara, Ph.D.*

Alexa Gonzalez-Morales
11:30 AM

Examining the Presence of Foreign DNA on Neck Swabs

Growing research suggests the increase of strangulation in sexual assault cases. In suspected strangulation cases, it may be possible to retrieve touch DNA from a survivor's neck and detect the DNA profile of the perpetrator. However, it is imperative to first understand if foreign DNA is present on an individual's neck even without a strangulation event. This study examined the presence of foreign DNA on a subject's neck after exposure to everyday activities. Reference and neck swabs were obtained from volunteers. DNA from the swabs was extracted, quantified, amplified, and genotyped. Reference profiles were compared to the DNA profiles obtained from the neck swabs to identify the presence of foreign DNA. The presence of foreign DNA across neck samples was inconsistent, but proves foreign DNA may be present without a strangulation event. This research will impact the forensic community by determining the validity of neck swabs as forensic evidence when strangulation events are suspected.

Committee Members: L. Kathleen Sekula, Ph.D.; Sara E. Walker, M.S.; Pamela Marshall, Ph.D.; and *Lyndsie Ferrara, Ph.D.*

Chloe Rapp
1:00 PM

Healthcare Disparities: A Comparative Analysis of Forensic Nursing and Sexual Assault Prevalence

Sexual assault forensic/nurse examiners (SAFE/SANEs) perform the physical and forensic examination for those seeking medical care following a sexual assault. The rising prevalence of sexual assault crimes continues to overwhelm the professionals qualified to treat survivors. The collection of a sexual assault kit may cause traumatization and physical pain, leading many to seek resources to mitigate this process. In a time of rapid technological expansion, it is imperative for the forensic nursing discipline to follow suit. This research investigated the disparities within forensic nursing through an analysis of the systematic increase of cases, a comparison of current statistics, the role of SAFE/SANEs, and secondary resource accessibility. It is expected that with this research, the efficiency of sexual assault crime prosecution shall progress through the development of multidisciplinary communication among the forensic, legal, and medical fields. The overall impact will decrease the number of survivors denied justice in the United States.

Committee Members: Lyndsie Ferrara, Ph.D.; Matthew Regentin, M.S.; Joyce Williams, D.N.P, R.N.; and *Pamela Marsha*ll, Ph.D.

Gabrielle Gibbons
1:30 PM

Examining Solutions to the Sexual Assault Kit Backlog

The Sexual Assault Kit Backlog is the mass accumulation of untested Sexual Assault Kits (SAKs) that were not submitted for DNA testing across America. Since the mid 2000's, there has been a recognition of SAKs as a useful investigative tool and a push for the mass testing of backlogged kits. While many techniques for reduction have been examined throughout the movement, there has never been an amalgamation of the methods to determine if there is a best practice over varying levels of jurisdiction. Post review of the techniques specifically from Texas, North Carolina, and Maine, it has been revealed that federal funding is necessary to organize reduction and supply laboratories for testing. However, nonprofits and advocacy can aid in pre-legislative education and funding which pushes the government to action, and innovations in collection of the SAK, and Straight to DNA testing provide faster turnaround times for investigators and survivors.

Committee Members: Matthew Regentin, M.S.; Nancy Downing, Ph.D., R.N.; Lyndsie Ferrara, Ph.D.; and *Pamela Marshall, Ph.D.*

Zarena Nieves-Figueroa
2:00 PM

Implicit Bias and the Link to Juror Selection in Capital Punishment Cases

Juror selection bias is the counterpart of the controversial term 'jury bias'. Although both play a crucial role in sentencing, research on biases during jury selection is limited. This study addressed this gap by researching available literature (Phase I) and interviewing prosecutors, defense attorneys, and judges with a defined set of questions (Phase II). Results were compared and a trend that biases obtained in Phase II were consistent with those from Phase I was observed. Common biases were related to race, criminal background, sex, and socioeconomic status. Additionally, a lack of data on the make-up of juries from cases that have gone to trial was identified. These findings expose another factor that may lead to miscarriages of justice. With hope, this research will lead to an increased awareness of implicit biases in the legal community such that future juror selection is fair and balanced for the defendant.

Committee Members: Lyndsie Ferrara, Ph.D.; Bobbi Jo Wagner, J.D.; Elizabeth DeLosa, J.D.; and *Pamela Marshall, Ph.D.*

Jocelyn Rodriguez
2:30 PM

Using Virtual Reality as a Format of Crime Scene Presentation by an Expert Witness during a Mock Jury Trial in the United States

Virtual Reality (VR) has been making its way into many fields, including forensic science. This research examines the impact of three presentation formats on a juror's comprehension of a crime scene, with an expert witness testimony. The three formats were: "normal", "3D", and "VR". For each presentation, a juror listened to a mock expert witness testimony using one of the three formats and took a quiz afterward. "Normal" used photographs and a sketch, "3D" used a 3D model, and "VR" used an immersive virtual environment (IVE) of the 3D model. The "VR" presentation placed the expert in the IVE and guided the juror through the scene. This contrasts prior research where the jurors were in the IVE, which is not practically feasible in many courtrooms. Comprehension scores were similar across each format. However, answers within formats had consistent miscomprehensions. Despite this, the VR and 3D models were helpful to jurors.

Committee Members: Emily Rancourt, M.S.; Kimberly Rule, M.S.; *Pamela Marshall, Ph.D.*; and *Lyndsie Ferrara, Ph.D.*

Abigail Noll
3:15 PM

Identification and Quantification of Illicit Drugs in Blood Using Stir Bar Sorptive Extraction and LC-QQQ-MS

The danger proposed by illicit drug use has led to further research into more sensitive substance detection and identification techniques for biological samples. In this study, polydimethylsiloxane-coated magnetic stir bars were used to extract analytes correlating to a fifteen-drug panel from blood samples. The drug panel included illicit substances such as fentanyl and heroin and medical prescriptions like oxycodone and methadone. LC-QQQ-MS with a biphenyl column was used for separation and quantification of these analytes. A five- drug panel of 6-acetylmorphine, benzoylecgonine, EDDP perchlorate, fentanyl, and noryoxycodone HCl were quantified utilizing internal standard calibration curves. Thirteen out of fifteen drugs were able to be extracted upon the addition of 0.25 M NaCl. Preliminary quantitation results were achieved. Victims and their grieving families would receive justice and closure by furthering research in drug extraction techniques that are more efficient, more sustainable, and more cost and time effective.

Committee Members: Ashley Ebert, Ph.D.; Sean Fischer, Ph.D.; and *Stephanie J. Wetzel, Ph.D.*

Kayla Houghton
3:45 PM

The Persistence of Human eDNA in Air

Environmental DNA, eDNA, is genetic material that organisms shed into their surrounding environment. eDNA deposited in air has been analyzed to track locations and travel patterns of live animals and determine the presence of species living in an environment. However, this application regarding airborne eDNA has not been studied in the forensic science discipline. The purpose of this study is to determine how effective air filtration is in obtaining eDNA from human remains stored in contained spaces. A frozen sample was placed into a plastic box for 72 hours, later increased to 120 hours. The air was then filtered for 3 hours to capture any genetic material dispersed into the air. The genetic material was extracted, quantified, amplified, genotyped, and compared to reference profiles developed from the tissue samples. The ability to generate a genetic profile from air would allow forensic scientists to gain another tool to obtain evidence.

Committee Members: Pamela Marshall, Ph.D.; Kari Danser, M.S.; Matthew Regentin, M.S.; and *Lyndsie Ferrara, Ph.D.*

Sydney Bivens
4:15 PM

DNA Extraction from Teeth Optimization and Subsequent DNA Mixture Analysis of Co-mingled, Burnt Remains (CBR)

The identification of mass disaster victims is an arduous task due to degraded nuclear DNA. This study aimed to determine the best extraction method from human teeth, including scenarios impacted by burning and co-mingling to simulate disaster sites. The three methods tested were an organic phenol-chloroform protocol, a bone specific Qiagen protocol, and a modified DNA IQ protocol. The Qiagen method performed best of the three with regards to higher DNA quantity and quality yields. For this study, two teeth were placed in the kiln for 10 minutes at 450°C, then pulverized to begin extraction. Afterwards, the mixtures were analyzed using the probabilistic genotyping software TrueAllele® Casework by Cybergenetics. The extraction did not produce genetic profiles due to degradation that occurred during the burning process. Further testing on compromised and mixed remains can provide more opportunities for identification from mass disaster sites, leading to closure for persons affected by tragedy.

Committee Members: Sydney Reed, M.S.; Kari Danser, M.S.; Matthew Regentin, M.S.; and *Lyndsie Ferrara, Ph.D.*

Rachel Westley
4:45 PM

Quantitative Determination of Heroin and Fentanyl in Dried Blood Spots on Various Surfaces

Dried blood spots (DBS) have recently been researched to detect drugs of abuse for toxicological purposes. Previous studies have shown that some drugs experience a stabilizing effect when using DBS cards which decreased the drug's degradation. This effect has not been confirmed using dried bloodstains outside of DBS applications. This study aimed to determine whether fentanyl and heroin could be detected and quantified from bloodstains on common household surfaces. A stability test was also performed for each surface tested to discover if there is a stabilizing effect on certain drugs similar to what has been observed using DBS. Analysis of bloodstains was completed using micro-solid phase extraction and liquid chromatography-mass spectrometry. The application of dried bloodstains for use in toxicology could open possibilities of using crime scene bloodstains to determine whether a perpetrator was under the influence of drugs during the crime.

Committee Members: Lyndsie Ferrara, Ph.D.; Lauren Stubbert, MS.; Erica Maney, MS.; and *Stephanie Wetzel, Ph.D*

Ian Smilnak
5:30 PM

The Efficiency and Efficacy of Male DNA Extraction from Sexual Assault Kits with Variations in Washes

Rates of sexual violence continue to increase in the United States. Technical inefficiencies and insufficient resources are commonly cited to explain the sexual assault kit (SAK) backlog. This research assessed modifications to the standard differential extraction utilized for processing samples containing seminal fluid from SAKs. Contrived SAK samples were created with female vaginal swabs from study participants and purchased seminal fluid (BioIVT: Westbury, NY). A modified differential extraction using Differex™ was then performed which involved maintaining the number of wash steps or decreasing washes to determine recovery of male DNA. Samples followed traditional means of DNA purification with QIAGEN® QIAamp® DNA Investigator® Kit. Quantifiler™ Trio and GlobalFiler™ were utilized for quantification and amplification respectively. The determination of success was based on decreased processing times while maintaining or improving metrics of DNA quantity, quality, and reproducibility. This research predicts the reduction of washes will decrease sample processing time without compromising recovery of male DNA.

Committee Members: Pamela Marshall, Ph.D.; and *Lyndsie Ferrara, Ph.D.*

Erin Pyle
6:00 PM

Ancient DNA Analysis Using Massively Parallel Sequencing (MPS) on Skeletal Remains from Rhodes, Greece.

The identification of human skeletal remains is crucial within forensic investigations related to mass disasters, unmarked burial sites, and military battles. This study used x-rays, osteology, and genetic data to obtain information from human skeletal remains recovered at a burial site in Rhodes, Greece. The remains date back to 500 A.D., which makes DNA recovery a challenge. There is currently no universal technique for ancient DNA (aDNA) extraction due to difficulties with degradation, contamination, the environment, and lack of a standard definition for aDNA. The UNT Center for Human Identification Demineralization Extraction protocol was used multiple times, with improvements between extractions aimed at increasing DNA yield. Despite these efforts, DNA quantities obtained from real time PCR were insufficient for analysis using Massively Parallel Sequencing (MPS). Future research should explore alternative extraction protocols to improve DNA recovery from ancient and damaged skeletal remains, enhancing forensic identification methods.

Committee Members: Sarah McKendrick, M.S.; Abigail McNamee, M.S.; Anne Burrows, Ph.D.; Matthew Regentin, M.S.; and *Lyndsie Ferrara, Ph.D.*

END OF SYMPOSIUM

DUQUESNE UNIVERSITY